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A Summary of Current Program, 10/1/64
and Preliminary Report of Progress
for 10/1/63 to 9/30/64

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RESOURCE DEVELOPMENT ECONOMICS DIVISION

of the

ECONOMIC RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

and related work of the

STATE AGRICULTURAL EXPERIMENT STATIONS

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CURRENT SERIAL RECORDS

This progress report of USDA and cooperative research is primarily a tool for use of scientists and administrators in program coordination, development and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

The summaries of progress on USDA and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members and others having a special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of USDA and cooperative research issued between October 1, 1963, and September 30, 1964. Current economic research findings are also published in the ERS publications Agricultural Economics Research, a quarterly, and The Farm Index, a monthly. This progress report was compiled in the Resource Development Economics Division, Economic Research Service, U. S. Department of Agriculture, Washington, D. C. 20250.

UNITED STATES DEPARTMENT OF AGRICULTURE

Washington, D. C.

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TABLE OF CONTENTS

	<u>Page</u>
Introduction	ii
Area No. 1. Economics of Land Utilization	7
Area No. 2. Economics of Water Utilization	12
Area No. 3. Resource Tenure Institutions	18
Area 3A. Legal-Economic Aspects of Land and Water Use	18
Area 3B. Land Tenure	23
Area No. 4. Resource Income Distribution	29
Area No. 5. Impacts of Urban Growth on Rural Areas	30
Area No. 6. Economic Development Problems and Programs in Rural Areas	34
Area No. 7. Incomes, Employment and Resources of People in Selected Rural Areas.....	39
Area No. 8. Rural Area Economic Structure and Economic Growth..	42
Area No. 9. Economic Framework and Criteria for River Basin and Watershed Development	46
Area No. 10. River Basin Development Investigations	51
Area No. 11. Watershed Program Analysis	56
Line Project Check List	63

INTRODUCTION

Resource development economics research deals with many and varied economic problems of land- and water-resource management and rural area development. The work is concerned with the extent, use, development and control of land and water resources and rural area economic development, including the economics of land and water utilization, legal-economic aspects of land and water use, tenure, resource income distribution, and impacts of urban expansion; area economic development problems, programs, structure, and renewal and growth potentials; river basin and watershed project and program planning and evaluation; and development and implementation of resource policy.

Continuing pressure on shifts in land- and water-resource use is being exerted by both improved technology in agricultural production and expanding non-agricultural requirements. Trends toward increased size of farms and reduced farming opportunities, along with increasing concern over the development, use, and conservation of the Nation's land and water resources, and growing apprehension over the problems and welfare of rural people and rural economic opportunities require a thorough and comprehensive program of research in the field of resource development economics. Results of resource economics research are used widely as aids in management decisions at the farm, community, area, State, regional, river basin, and national levels.

The Department's program of research and related service in resource economics is conducted from headquarters in Washington, D.C., and is concerned chiefly with types of problems that are regional or national in scope. Field studies generally are conducted in cooperation with State experiment stations or Federal and State resource development agencies. Close working relationships with both research and operational programs have long been traditional in this field. Close cooperation in planning and conducting work avoids duplication of efforts and provides opportunities for the direct application of research results.

In September 1964 certain functions and personnel of the Land and Water Branch were realigned. The Legal-Economic Aspects of Land and Water Use and Land Tenure Investigations were combined into the Resource Tenure Institutions Investigations and a new investigations unit--Resource Income Distribution--was formed. The resource economics research program is covered under 11 area headings shown in the Table of Contents. More detailed subheadings are given in the discussion of each area of work.

In the 12 months since progress was last reported, the Division has made a number of significant contributions to resource policies and programs. Division personnel have responded to many requests for assistance from the Office of the Secretary, program administrators, the President's Water

Resources Council, the Federal Council for Science and Technology, the office of Economic Opportunity, the Recreation Advisory Council, the President's Appalachian Regional Commission, and others. In addition, basic data and analyses provided by the Division have become increasingly important in efforts to understand changes and achieve improvements in the development and use of resources, the structure of the rural economy and the well-being of agriculture. Some examples of research accomplishments contributing to resource policy and programs follow:

Land use. A survey of State-owned lands indicates that the 50 States hold almost 85 million acres of rural land, 27 million acres of which are used for such purposes as parks, recreational areas, State forests, wildlife reserves, and institutional sites. Grazing predominates on the remaining 58 million acres, with farming and forestry of less importance.

Analyses of trends in the acreage of cropland used for crops indicate that 336 million acres were used in 1963, an increase of 2 percent over 1962. About three-fourths of the increase occurred in the Corn Belt, Lake States, and Northern Plains Regions, and resulted principally from increased plantings of corn, wheat, soybeans, and sorghums.

Water use. A study of the 24 major water-resource regions indicates that irrigated acreage is currently expanding at an annual rate of 8 percent in the East, 2.9 percent in the West, and 3.2 percent nationally. It is estimated that in 1964 the acreage irrigated totaled between 36.6 and 38.5 million acres, of which the Western States accounted for between 33.9 to 35.4 million acres. This may be contrasted with the 1959 Census report of 33.16 million acres nationally, with 1.9 million acres in the East, 31.1 million acres in the West, and the remainder in Hawaii.

Land-use regulations. A survey of zoning enabling laws indicates that authority to zone in unincorporated or rural areas is available to nearly three-fourths of the 3,000 counties of the United States. Generally, all or selected counties may zone in the South and West; all or selected towns or townships in the Northeast; and both counties and towns or townships in most Lake States. More than 400 counties and nearly 1,700 towns or townships have adopted zoning ordinances.

Crop restricting easements. A study in Nebraska of the possibility of government purchase easements restricting the right to grow crops indicates that the average annual cost of reducing production by one bushel of corn or output equivalent would have been 26 cents under the assumed method, as compared with 69 cents under an expanded lease program similar to the Conservation Reserve Program.

Landownership in the Southeast. A study of landowners in the Southeast indicated that nonwhite owners comprised 12 percent of all rural landowners. They owned 7 percent of the land. Compared with white landowners, nonwhites were

older and they first acquired land at an older age. The rate of land transfer was lower for this group and they relied more heavily upon inheritance as a method of acquisition. Nonwhites more frequently held land in undivided, multiple-owned units.

Differential changes in factor returns. Returns to land and labor from tobacco farming for the period 1922-60 were analyzed for one region in Virginia and one in North Carolina. In this period, income from tobacco increased more than sixfold in both areas. Labor earnings of sharecroppers increased at about the same rate. Land returns, however, increased by twelvefold in Virginia and ninefold in North Carolina. For farms using hired laborers, land returns increased even more--21-fold and twelvefold for the two regions respectively--while returns to hired laborers increased about fourfold or less than the increase in total tobacco income. From 1954 to 1959 in the sample counties, croppers declined by 48 percent, a larger drop than the other tenure groups, while regular hired workers increased by 60 percent.

Rural poverty. A study of rural poverty showed that in 1960 more than 17 million of the 35 million people with incomes below the established poverty income level--\$3,000 for families and \$1,500 for unrelated individuals--lived in rural areas. Approximately 6 million of these people lived on farms. Of the 4.4 million rural families classed as low-income, only 758,000 or 17.2 percent were nonwhite. Of all rural families, 1.1 million of the farm and 1.8 million of the nonfarm received less than \$2,000 annual income.

Approximately 56 percent of the rural poverty is found in the South. The highest concentration of rural farm poverty occurs in the heavy cotton and tobacco producing areas of the Southeast. A lesser concentration is also found in an area of western Ohio, eastern Indiana and southern Michigan, as well as in Missouri, Iowa, and southern Minnesota and Wisconsin.

Rural nonfarm families with incomes under \$3,000 have their greatest concentration in the Appalachians from southeastern Pennsylvania to northern Georgia.

Sources of farm operator family income. The sources of family income were determined for a sample of farm families by matching data from the 1959 Census of Agriculture and the 1960 Census of Population. Farm operator families obtained 46.9 percent of their income from the farm business, 43.7 percent from wages or salaries and 9.4 percent from other sources. Approximately 80 percent of the family income of all farm operator families was contributed by the farm operator. Only 57.2 percent of the income of families of commercial farm operators came from the farm business.

Families operating the relatively larger economic classes of farms, which comprise one-fourth of all farms, were the only size of farm business groups for which more than half of family income was derived from farming operations.

Between 1949 and 1959 the relative importance of farming as a source of family income decreased significantly for all sizes of farms. This decrease was most dramatic for families operating farms having sales between \$2,500 and \$9,999.

Income opportunities for rural people from outdoor recreation. Many low-income areas possess the natural attributes desired by recreationists--wooded hills, streams, lakes, and abundant wildlife. Studies of recreation opportunities on farms and other rural lands in six areas of the United States showed that profits from recreation enterprises were not certain. Limited profits were due in large part by too few customers and to enterprises too small in size. The operator's ability to attract and keep patrons was extremely important and depended heavily upon the degree to which he enjoyed associating and working with people. Successful private ventures were often located near a public facility. They provided something in addition to the public facility, or cared for the overflow of people attracted to the public facility.

Capital investment in recreation enterprises ranged from \$151,000 for summer camps to only \$1,600 for a guide service. Less than half the enterprises studied returned a positive income to labor and management of the operator and family when a charge of 5 percent on investment was made. Many recreation enterprises developed on farms as a secondary source of income later became the primary source of income. The rapidly expanding and changing demand for recreational activities may cause facilities to become obsolete in a relatively short time.

Nature of the low-income problem in Appalachia. Although Appalachia has a disproportionate share of the Nation's unemployed workers and low-income families, considerable variation exists among subareas of the region. This variation reflects in part recent differential growth rates in employment and population among subareas. The variations in the incidence of both unemployment and low incomes appear to be related to the geographic location of the subareas in the region and to the size of their urban centers. Although rates of unemployment and proportions of families with low incomes are highest in the more rural subareas with small population centers, the bulk of the unemployed and the low-income people reside in the large population center subareas.

Low incomes in the rural subareas resulted in the availability of fewer financial resources on a per capita basis than were available in the more urbanized subareas of Appalachia for providing for needy citizens, supporting education and public facility improvements, or for promoting industrial development. This study indicates that the formulation of a development strategy for Appalachia should rest on the development of programs to expand economic activities in areas that possess potentials. Recent growth patterns of subareas in Appalachia suggest that the larger urban and the peripheral subareas appear to have the greatest propensity to expand economic activities.

Interregional analyses and projections for river-basin planning. With the active participation of the Forest Service and the Soil Conservation Service, ERS is providing overall technical leadership for a newly instituted USDA program of investigations for river-basin planning. These involve inter-regional analyses and projections of agricultural economic activity and land use. The primary purpose of the new program is to develop an interregional framework of projections required for effective consideration of the economic aspects of agriculture, forestry, and land use in river-basin planning. An agricultural data bank is also being developed to provide for the tabulation, analysis, and updating of currently available pertinent data about agriculture, land use and the rural economics for all counties of the Nation. Based upon specific assumptions with regard to such factors as population growth, consumer income, consumer preferences, exports and imports, and per capita consumption, estimates of regional requirements for food and fiber products through 1980 have been developed. National requirements were allocated to 10 regions based upon such factors as historical contribution of regions to the total agricultural product requirements and reductions or increases in the regional resource base. These activities are elements in a closely coordinated program sponsored by the Department of Agriculture and other departments of the ad hoc Water Resources Council. It involves participation by the Office of Business Economics, Department of Commerce, and other Federal agencies.

Economic impacts of water resources development. Economic impacts of water resources development projects are not limited to primary benefits. Within the economic community, total gains traceable to the project include income to sectors of the economy affected indirectly. Such sectors include firms and households supplying services and goods used in production, processors and distributors of project goods and services, and vendors of goods and services for final consumption. Knowledge of the nature and incidence of these secondary benefits is useful to planners and operating units for information and education, obtaining acceptability of the project, cost sharing, and other purposes. An awareness within the community of the interrelationships among sectors of the economy can provide an impetus to resource development and improved management for increased growth. A study of secondary incomes in Roger Mills County, Oklahoma, indicated that for each \$1 increase in net farm income, an additional 62 cents in net income accrued to local nonfarm residents. This study also showed that the magnitude and distribution of local secondary impacts were influenced by the economic structure of the community, and the specific purposes of the project.

AREA NO. 1. ECONOMICS OF LAND UTILIZATION

Problem. Population growth, advances in agricultural production technology, changing consumer demands, and other factors combine to cause changing demands for the Nation's fixed supply of land. Analyses of levels and trends in the major uses of land, the economics of land development and conservation measures, and the need for shifts of land between alternative uses provide the basis for informed policies and programs of land use adjustment and the conservation and development of land resources.

USDA AND COOPERATIVE PROGRAM

Research in the economics of land utilization is divided into two subareas: (A) inventory and appraisal of land supplies and uses; and (B) land requirements, conservation, and development. This research provides a continuing inventory of major land uses, both farm and nonfarm, regional and national; analyzes trends in the nature and intensity of land use by States and regions, including shifts in major agricultural uses and acreages absorbed by nonagricultural uses; appraises historical programs of cropland retirement and conversion as a basis for decisions relating to current problems of land use; evaluates the need for land conservation and development measures; and analyzes projected national agricultural output requirements and nonagricultural land needs in terms of the adequacy of the land-resource base, and implications for patterns of production.

Research in this area is principally applied although particular segments of the overall program may be considered as basic research. The nature of the research makes it necessary to draw upon several scientific disciplines, including economics, statistics, geography, soils, botany, agronomy, and forestry. During the reporting year, research was formally cooperative with the Iowa Agricultural Experiment Station. A research contract was executed with the Purdue Research Foundation. In addition, there was informal cooperation with many State and Federal governmental agencies, and other organizations.

Approximately 4.0 professional man-years were devoted to this area of research during the reporting year, including non-Federal professional personnel working under cooperative agreement and contract.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations research in this area is somewhat more localized and more on a problem basis than that carried out by ERS. Thus, the two programs are designed to supplement each other. Some of the research analyzes

the economic potential for adjustment to new technological and economic conditions possessed by each of the major land classes and the resource combinations necessary for the operators to achieve specified minimum incomes. For such analysis some divide the State into homogeneous areas as to soils, climate and other characteristics. In the Western States studies are made of the policies and practices which result in success for Desert Land Entry and how State and Federal land is used in conjunction with private land operations and the rental or fees charged.

Throughout the Great Plains States and all of the Eastern States there is a continuing process of farm population decrease and studies are made as to the extent to which this is due to farm enlargement or land abandonment and the human and community adjustment problems which this brings about.

Because of the growing interest in outdoor recreation, several States have projects studying the possibilities of multiple land use and the practices used and problems encountered by forest land owners who permit the public to camp, hunt and fish on their lands. Some States have projects designed to project long-range land use plans for the State on the basis of projected demands for products and changes in comparative advantages with other States.

A total of 5.0 professional man-years is devoted to this area of research.

PROGRESS--USDA AND COOPERATIVE PROGRAMS

A. Inventory and Appraisal of Land Supplies and Uses

Completion of an inventory of the extent and use of State-owned lands shows that the 50 States, collectively, hold title to almost 85 million acres of rural land. About 27 million acres are used for specific purposes such as parks and recreational areas, State forests, wildlife reserves, and institutional sites. Grazing is the predominant use of the remaining 58 million acres with farming and forestry less important uses.

Size of land holdings varies greatly among the States. Acreages are relatively large in most Western States, the Lake States, New York, Pennsylvania, Alaska, and Hawaii. Grants of land from the Federal government were the means of ownership for more than 60 percent of the State-owned land. Much of the remaining acreage was acquired through tax foreclosure and to a lesser extent by purchase.

Analyses of trends in the acreage of cropland used for crops indicate that 336 million acres were used in 1963, an increase of 2 percent over 1962. About three-fourths of this increase occurred in the Corn Belt, Lake States, and Northern Plains Regions, and principally resulted from increased

plantings of corn, wheat, soybeans, and sorghums. Only the Mountain Region showed a decrease in the acreage of land used for crops, and it was slight.

An appraisal of the Land Utilization Program of the 1930's has been completed and a draft manuscript prepared. Under this program the Federal government purchased 11.3 million acres of submarginal or unproductive farmlands for conversion to conservational uses. Current predominant uses of these purchased lands are: National grasslands, 3.8 million acres; National forests and related areas, 1.6 million acres; Federal grazing districts, 2.5 million acres; Indian range, 1.0 million acres; National parks and wildlife refuges, 0.8 million acres; State forests, 0.7 million acres; State and local parks and wildlife refuges, 0.6 million acres; and miscellaneous other areas, 0.2 million acres.

The present condition of these areas varies greatly. Many of the projects in the Eastern and Lake States contain stands of merchantable timber now ready for selective cutting. Grasslands in the Western States provide excellent grazing. Attractive recreational facilities have been developed in some areas. In many instances, lakes were developed in States where few natural bodies of water exist and are now extensively used for recreational purposes.

Conservation practices, seeding of rangelands, forestation and other improvements were applied to these lands to bring them into productive uses. Many projects now appear to be serving beneficial purposes through use as demonstration areas for proper land management and conservation practices by providing rural recreational areas and wildlife refuges. Some areas supplement incomes of local people from grazing and forestry and through employment in project maintenance and operation. A share of the net income from these projects, usually 25 percent, is paid to local governments for the support of schools and roads.

Participation in the activities of a committee concerned with the improvement of land use statistics, consisting of representatives from many Federal agencies and other organizations, has culminated in a draft manuscript authored outside of USDA. This manuscript presents concepts relating to land use statistics, reviews problems associated with their collection and interpretation, and develops the elements of an improved statistical system.

Research to identify the best types of aerial photography for purposes of land use identification and to develop interpretive keys was initiated near the end of the reporting year. Photographs taken with different film and filter combinations, from different altitudes, at different times of the day, and throughout the growing season are being evaluated. They were taken over an area for which the vegetative cover is known.

B. Land Requirements, Conservation, and Development

Recent tentative projections of agricultural land requirements to 1980 indicate that the increased food and fiber needs of a larger population will be approximately met by greater per acre crop yields to hold the acreage requirement of land used for crops at about the current level. However, additional needs for rotation pasture and open permanent pasture and range are foreseen.

Exploratory work has been undertaken in an attempt to develop productivity indexes for land capability classes from secondary data. Data for the State of Iowa have been analyzed and the results only moderately encourage extension of the method to other areas. Limited work directed towards identifying factors contributing to inter- and intra-regional shifts in patterns of land use has been initiated. This research has not progressed to the point of reportable results.

AREA NO. 1.--ECONOMICS OF LAND UTILIZATION

PUBLICATIONS--USDA AND COOPERATIVE PROGRAMS

A. Inventory and Appraisal of Land Supplies and Uses

Changes in farm production and efficiency--a summary report. 1964.

Statis. Bull. No. 233. U. S. Department of Agriculture. Paragraph p. 2--Cropland Used for Crops--and pp. 14-18.

Supplement II to changes in farm production and efficiency--a summary report. 1964. Statis. Bull. No. 233. U. S. Department of Agriculture. pp. 1-7.

B. Land Requirements, Conservation, and Development

Shrader, William D. and Landgren, Norman E. 1964. Land use implications of agricultural production potentials. In Shifts in Land Use. Department of Agricultural Economics Report No. 33. Nebraska Agr. Expt. Sta. pp. 3-25.

AREA NO. 2. ECONOMICS OF WATER UTILIZATION

Problem. The efficiency with which ground and surface water resources are managed in the agricultural sector of the economy has a direct bearing on the productive efficiency of land and other **natural** resources. Modest gains in the efficiency of agricultural water use will result in substantial increases in supplies effectively available for all uses, particularly in western regions where irrigated agriculture is an important segment of basin economies and water supplies are already inadequate for all beneficial purposes. Continued expansion of irrigation in the East and nationwide water pollution problems make the economic management of water in agriculture in most areas an important factor in balanced economic growth and the effective development of all water-using industries, including agriculture itself.

USDA AND COOPERATIVE PROGRAM

Current investigations are concerned both with providing economic facts on water supplies, uses, and management needs as they concern farmers, legislators, or administrators and with analyzing resulting implications for water management decisions. Intensive studies are concerned with developing economic principles and techniques appropriate to the analysis of agricultural water problems, complete regional inventories of water supplies and uses, and with the estimation of water values necessary for determining the feasibility and profitability of new water supply technologies or management practices, small watershed projects, and broad river basin programs. The work is discussed here under two subareas: (A) Inventory and appraisal of water resource supplies, uses, and values; and (B) Water requirements, allocation, and conveyance efficiencies. About 55 percent of the present USDA program can be termed basic economic research, with the remaining 45 percent representing applied economic studies and data collection necessary for both basic and applied studies.

Subject matter fields involved, in addition to economics, include hydrology, agronomy, engineering, statistics, and law. About 35 percent of the research effort is centered in Washington, D. C. Major Washington studies include compiling, analyzing, and interpreting source material; developing improved techniques for evaluating watershed and river basin development projects; accumulating regional data on available land and water resources classified by productivity; and analyzing regional irrigation trends and potentials.

Water inventory and appraisal studies are cooperative with the Colorado and Oregon Experiment Stations. ERS researchers are located at each Station. These studies deal primarily with estimating the value of water for

irrigation and alternative uses in Colorado and the Pacific Northwest. Water requirements, allocation, and efficiency research is cooperative with the California Station.

Formal cooperation with nearly all States is also maintained through ERS participation in the activities of regional committees interested in the economics of agricultural water management. ERS has developed and is currently conducting research formally contributing to a North Central regional study of economic and legal factors in agricultural water use, and to a Western regional study of legal-economic aspects of water reallocations or transfers between agricultural and competing water uses, and to another Western regional project on the economics of on-farm water use. Also, the Southern Land Economics Research Committee has a Subcommittee on Water Resources through which ERS coordinates its research activities involving water management in the South.

A new activity made possible with supplemental funds for FY 1965 concerns the effects of pesticide residues on farmstead water supplies and management problems created thereby.

Research in the economics of water utilization currently totals about 7.0 professional man-years.

PROGRAM OF STATE EXPERIMENT STATIONS

Several of the western States are concerned with the increase in the number of demands for water in areas where all or nearly all of the water has been dedicated to agricultural use and safeguarded for such use through laws and other institutional means. The traditional allocation of the water may not be in the best interests of the community and may retard development other than agriculture. To arrive at logical conclusions as to the most productive use of water the States are developing information to show the marginal value of water for various uses. In some areas where water is plentiful there is a tendency to use too much water so as to save on labor costs. This may result in poor drainage and lowered yields. The research is designed to determine the optimum combination of water, labor and capital. Local studies are made to evaluate the water supply situation in local areas, the economic impact of proposed development upon the agricultural economy of the area, the changes in farming methods and systems required to convert from dry land to irrigated farming and the extent to which dry land and irrigated agriculture may be combined for a more stable income flow.

In the Eastern States attempts are being made to determine the value of water for competing uses in agriculture, recreation, industrial and residential. A limited amount of research deals with the possibility of safeguarding crop yields in dry years or dry seasons through irrigation and

the input-output relationship of such practices. Some attention is being given to the cost of water pollution problems and how these may be overcome.

A total of 7.0 professional man-years is devoted to this area of research.

PROGRESS--USDA AND COOPERATIVE PROGRAMS

A. Inventory and Appraisal of Water Resource Supplies, Uses, and Values

Appraisals of agricultural water uses and supplies resulted in an administrative report on "Rural and Urban Water Uses in the United States, 1960". It compiles by major water resource regions, compatible data from numerous sources on irrigated acreage trends and agricultural water uses (both withdrawal and consumptive), with particular respect to uses supplied from surface and ground sources. Comparisons with urban uses are included. The report describes, for each of 24 major water resource regions as defined for the Senate Select Committee on National Water Resources, a benchmark situation of agricultural water use, with supplementing data on the rate at which irrigated acreage is currently expanding; i.e., at 8.0 percent per year in the East, 2.91 percent in the West, and 3.17 percent nationally. This research suggests that between 36.6 and 38.5 million acres of irrigated land will be reported in the 1964 Census of Agriculture for the United States; between 2.75 and 3.10 million acres in the eastern States and between 33.9 and 35.4 million acres in the western States. In comparison, totals reported in the 1959 Census were 1.87 million acres in the East, 31.15 million acres in the West, and 33.16 million acres nationally, including Hawaii.

A methodological study of irrigation potentials was completed for the Coastal Plain and the Piedmont resource areas of North Carolina. Potentials were first defined in terms of three categories of the relative profitability of irrigation, and individual soil types were then classified by these categories (using sample data from the National Inventory of Soil and Water Conservation Needs); statistical estimates of the three potentials were then developed for counties, resource areas, and river basins. A high degree of correspondence between acreages with the highest probability for profitable irrigation and classified as Class I land in North Carolina under the SCS capability classification system was noted, suggesting that the procedure, with precautions, could be generalized to the entire Coastal Plain and Piedmont with reference to capability data available in the Conservation Needs Inventory.

Research on the value of water if used for irrigation in Colorado resulted in three technical bulletins plus several popular features. As reported in the Colorado Technical Bulletin 78, major emphasis was on

statistical regression procedures for inferring water values from an analysis of 337 recent farm sales transactions in northern Colorado in which water entitlements were transferred with land titles. Nearly all of the regression estimates were statistically significant at an acceptable level of probability. The estimated mean value of company water for the four counties was \$21.53 per acre-foot and the estimate for Colorado-Big Thompson water was \$25.71 per acre-foot. The value estimates for both company and Colorado-Big Thompson water varied between counties, subareas and by size of farms, reflecting the heterogeneous nature of supply operations in the area as well as imperfections in the market for water. Reported sales of company water stock indicate values within the range of regression estimates. Recent prices paid for Colorado-Big Thompson water are higher than the regression estimates, reflecting an increasing demand for Colorado-Big Thompson water for domestic purposes. Irrigation water pumped from wells was valued at \$29 per acre-foot. This research indicates that regression analysis of farm sales data can provide reliable estimates of water values for resource development and water conservation planning purposes.

Publication of empirical results of research on irrigation water values in the Willamette Valley of Oregon is being deferred pending analysis of data for the 1964 crop season. Water values have been estimated in two major ways: (1) Production function analysis using survey data; and (2) Production function analysis using data from controlled experiments. Data were obtained from a survey of field corn and bush bean irrigation operations in Benton, Linn, Marion, and Polk Counties of Oregon, and from controlled experimental irrigation of field corn and bush beans. A Cobb-Douglas function was first fitted to the survey data. The marginal value productivity schedule for water was derived for each crop and the optimal irrigation application rates derived. Survey functions have been compared with their experimental counterparts, indicating that over the survey range of the water input, a close similarity existed between the functions. Controlled experimental work, therefore, should be used more widely as guidelines for efficient use and allocation of water resources. Programing models incorporating experimental water applications and response coefficients have, generally, indicated greater possibilities for maximizing returns from irrigation than models incorporating the typical application rates and yields observed in field surveys in the Willamette Valley.

B. Water Requirements, Allocation, and Management Efficiencies

In connection with improved methods for the economic evaluation of land and water resource development activities, ERS participated in the preparation of Evaluation Standards for Primary Outdoor Recreation Benefits issued in June 1964 by the President's ad hoc Water Resources Council as the first supplement to Senate Document 97, issued in May 1962. The supplement suggests standards and procedures for evaluating benefits associated with the use by outdoor recreationists of direct recreational services made available by water resource project facilities.

Research on the economics of watershed management has been limited to preliminary analyses of variations in yields of corn, cotton, and oats, associated with the inauguration of conservation practices in the Texas Blacklands. Crop yields and hydrologic data for the period 1938-63 for a study and a control watershed were obtained through the Agricultural Research Service from its Blacklands Experimental Watershed near Waco, Texas. Present indications are that increased crop yields on the conservation area are correlated to some degree with reductions in maximum instantaneous rates of runoff observed for each season, but to a lesser degree with other hydrologic variables.

Cooperative research with the Iowa Experiment Station on the economics of land forming for water management in the Eastern States has been completed.

A general analyses on the economics of planning large-scale water conveyance systems for irrigation and related purposes has been completed in cooperation with the California Experiment Station. A comprehensive economic model was developed embracing such major design variables as the quantitative, qualitative, and locational aspects of projected water demands, quantities, and sources of supplies subject to conveyance; size economies for alternative system components (canals, tunnels, pumping stations, etc.); and the management objectives of planning groups as such. A case study in depth was conducted on conveyance planning on the Madera Canal which illustrates the practical application of the conceptual model and indicates the empirical significance of specific problems likely to be encountered in similar efforts. A final part of the analysis deals with suggestions for the improvement of current planning procedures, drawing both from the model and from the Madera case study. It is expected that this material will be published in the coming year.

Concerning economic appraisals of water resource development in the Lower Mississippi Valley region, a major book (25 chapters in all) is rapidly moving toward completion. It details the history of land settlement in the Lower Mississippi Valley and includes related economic studies of flood control, drainage, bank stabilization, and other resource development activities where water management is basically a tool for land protection or development. Several of these chapters have been published in preliminary form in journals and other periodicals over the past several years. Some material on the economics of bank stabilization also has been prepared under this activity.

AREA NO. 2. ECONOMICS OF WATER UTILIZATION

PUBLICATIONS--USDA AND COOPERATIVE PROGRAMS

A. Inventory and Appraisal of Water Resource Supplies, Uses, and Values

Davan, Clarence F., Jr., Anderson, Raymond L., and Hartman, L. M.
1963. Agricultural characteristics and fertilizer practices in the
Cache La Poudre-South Platte irrigation area of northeastern
Colorado. Colo. Agr. Expt. Sta. Tech. Bul. 78. 24 pp.

Gertel, Karl. 1964. Economic potentials of irrigation in North
Carolina: based on soil classification and acreage estimates from
the National Inventory of Soil and Water Conservation Needs.
ERS-187. 25 pp.

Hartman, L. M., and Anderson, Raymond L. 1963. Estimating irrigation
water values: a regression analysis of farm sales data from north-
eastern Colorado. Colo. Agr. Expt. Sta. Tech. Bul. 81. 28 pp.

B. Water Requirements, Allocation, and Management Efficiencies

Davan, Clarence F., Jr., and Anderson, Raymond L. 1963. Economic
analysis of phosphate fertilizer on irrigated alfalfa in north-
eastern Colorado. Colo. Agr. Expt. Sta. Tech. Bul. 80. 14 pp.

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AREA NO. 3. RESOURCE TENURE INSTITUTIONS

AREA NO. 3.A. LEGAL-ECONOMIC ASPECTS OF LAND AND WATER USE

Problem. Efficient allocation and use of land and water resources is conditioned by the laws, administrative measures and related institutional arrangements that prescribe the rules and procedures for transfer, use and management of land and water resources. Rapid rates of population growth, urban expansion, imbalances in agricultural supply and demand, and technological change, necessitate improved measures to achieve an orderly and balanced pattern of land and water development and use. Research is needed on the current status and innovations in water law, water-use and transfer arrangements; rural zoning and other land-use regulations; the organization and operation of resource districts and interstate compacts; property rights in land, including public acquisition of various easements and other proper rights; and the impacts of public programs. Such information is needed and being requested by legislators, farmers, and public and private agencies concerned with means of achieving economic efficiency in the allocation and use of resources. The number and complexity of demands for information and technical assistance in this area continue to increase.

USDA AND COOPERATIVE PROGRAM

A continuing program of research is conducted to provide a systematic and continuing inventory and analysis of resource institutions and to focus on innovations in resource institutions permitting more efficient development and use of resources. The development and current status of statutes, constitutional provisions, and court decisions regarding water rights and associated laws in the 50 States are reviewed and analyzed, with attention given arrangements for transferring water rights and uses from lower-value to higher-value uses. Rural zoning enabling statutes and local ordinances are collected and analyzed with emphasis on the current status of, and recent innovations in, zoning. Consideration is given to the use of zoning arrangements for achieving the economical transfer of land resources from agricultural to nonagricultural uses. Enabling statutes and inventory data on special districts are analyzed as the background for further work on the economic efficiency of resource organizations used for developing and managing natural resources. Also analyzed are the feasibility of governmental purchase of crop-limiting easements as a production control and land-use adjustment device; impacts of public programs to control agricultural production; and farm impacts of such public projects as reservoirs and highways and methods for minimizing possible disruptive effects.

Research in this area is principally applied, although many phases of the program may be considered as basic.

Federal researchers conduct their legal-economic studies cooperatively with personnel at the Agricultural Experiment Stations of Arkansas, Nebraska, Pennsylvania, and the University of Wisconsin Law School. In addition, Federal personnel cooperate informally with many other researchers in other agricultural experiment stations and State universities and in State and Federal governmental agencies.

Approximately 7.0 professional man-years currently are devoted in this research program.

PROGRAM OF STATE EXPERIMENT STATIONS

Research in this area is closely intergrated with that of ERS and with the respective Law Schools in each representative State. Through cooperative arrangements, funds are sometimes provided by ERS and sometimes through the Regional Research Program for employing a law student to review the laws and relevant court cases in the State.

Most of the research in this area relates to water. The statutory and court laws in the State are studied for the purpose of determining the extent and conditions governing property and use rights with respect to water so as to develop a more comprehensive legal and institutional framework for guidance in the development and use of water resources. An analysis is made as to whether legal and institutional arrangements conflict with indicated best economic use of water and future needs.

One State has a cooperative project with ERS for evaluating the possibilities of using easements as a means of bringing about adjustments in land use and as a crop production control device.

A total of 6.0 professional man-years is devoted to this area of research.

PROGRESS - USDA AND COOPERATIVE PROGRAMS

A. Water Rights and Water Legislation

The comprehensive review and analysis of legal aspects of water rights in the 19 Western States was continued. About one-half of a two-volume book on a comparative analysis of the water rights laws of the Western States has been completed. Topics include State water policies; classification, definition and description of available water supplies; property nature of water and water rights pertaining to watercourses; appropriation, riparian and pueblo water rights systems; the protection, loss and administration of water rights; interstate and international matters; surface and ground waters.

A chapter on recent developments in State water laws was prepared as a contribution to a book on water law in the United States.

Research on legal aspects of water rights in the East involves several activities. Research carried out under contract by the University of

Wisconsin Law School on the legal and economic aspects of water rights in four midwestern States has provided basic material for five research reports, three of which are being prepared. The studies analyzed public and private water-use rights, rule of State agencies and local governments in shaping water rights, and various Federal and Constitutional problems. The studies have yielded considerable information regarding the operation of the laws and revealed both the complexity of existing water laws in a State and the differences between States. The five reports will consist of a publication on the water law of the States of Ohio, Indiana, Minnesota and Wisconsin and a comparative analysis of the laws of the four States.

A book on water-use law in Illinois prepared in cooperation with the University of Illinois, will be released shortly by the University of Illinois Press.

Progress was made in the cooperative study with the University of Arkansas concerning water laws in Arkansas. The portion of the manuscript dealing with functions of State agencies and local districts and units of government is being reviewed while other parts of the manuscript are in preparation.

Other research in which progress was made includes an analysis of the origin and historical development of the riparian doctrine and definitions of riparian land employed by courts in a number of States. A preliminary review of common law doctrines applicable to ground water in 16 Eastern States also was conducted. This research will be drawn upon in preparing a contemplated manuscript on water rights and related laws in the 31 Eastern States. Progress also was made in the preparation of a supplement to a previously published national bibliography on State water-rights laws and related subjects.

Active participation in the North Central regional research committee, Economic and Legal Factors in Providing, Using and Managing Water Resources in Agriculture (NC-57), included leadership in preparation of a bibliography of legal-economic research and agricultural law and related publication in the North Central States and co-leadership on the Wisconsin contributing project. The Wisconsin study is ascertaining relationships between the construction and development of 60 selected artificial flowages or impoundments and historical changes in the surrounding land values. The results of certain multiple regressions are being analyzed.

B. Land-Use Regulations

Work on the revision of Agricultural Information Bulletin No. 59, "Rural Zoning in the United States" is continuing. A new bulletin in two parts is contemplated, the first dealing with State zoning enabling legislation and the second with local zoning ordinances and regulations.

All 50 States have passed enabling laws that authorize zoning of unincorporated or rural areas in nearly three-fourths of the 3,000 counties in the

United States. Generally, all or selected counties may zone in the South and West; all or selected towns or townships in the Northeast; and both counties and towns or townships in most Lake States.

Analysis of zoning ordinances is underway. More than 400 counties and nearly 1,700 towns or townships have adopted zoning ordinances. Exclusive-type farm zoning districts for the protection of agriculture have been established in California and in nearly a dozen other States. Many other kinds of zoning districts for areas in the open country have been established. Among the latter are several kinds of agricultural zones, forestry and/or recreation districts, flood plain zones, watershed zones, and a variety of conservation zoning districts.

C. Resource Districts and Organizations

Economic appraisal of local resource organizations initiated last year was continued. Studies are being made to evaluate their effectiveness at all levels beginning with enabling laws under which organizations are established and continuing through their operations.

A case study of the legal provisions for special districts in Oklahoma was completed and reviewed. Criteria were developed for evaluating the enabling laws. The conclusions of the study are that Oklahoma statutes express the democratic processes and legal and financial powers quite clearly. Some thought could be given to the lack of reviewing agencies for some classes of districts. Cooperation with State or regional planning agencies is not required by statute. One of the principal benefits from such cooperation might be better allocation of resources through multiple use and coordination of activities.

An inventory of special districts and a working bibliography of related materials--important foundations for future work--are being developed. A manuscript is near completion on an inventory of special districts including comparisons of data such as the Census of Governments and the Census of Agriculture. A basic bibliography of materials on special districts published by legislative research councils of the State legislatures governmental research bureaus of the State Universities and other sources has been gathered. This will be published at a later date.

An outline for studying domestic water supply districts in Colorado has been prepared. Aspects of water supply districts to be studied include size of their operations, financial capability, tax impacts, cooperation with other governmental units, influence on suburban development, and other aspects.

D. Property Rights and Impacts of Public Programs

Analysis of the feasibility of easements and protective covenants for guiding rural land use was continued. Several production control programs have authorized making annual payments to farmers for taking land out of production.

Primarily, this project has focused on the feasibility of governmental purchase of crop restricting easements. Under the hypothetical program analyzed, the easements would be purchased by the Federal government. The easements would restrict production of grain and tilled crops, but would allow establishment and use of permanent grasses and trees. Landowners in six Nebraska counties were interviewed about their reactions to such a program and the payments they would require. All field work and data processing and legal analyses have been completed. The average annual cost of reducing production by one bushel of corn equivalent of output was 26 cents by easements compared with 69 cents under an expanded lease program similar to the Conservation Reserve Program. Two manuscripts reporting these findings are nearly ready for publication.

A special study of constitutional and statutory aspects of using easements for soil and conservation and for production control was completed and is in manuscript form. The legal analyses showed that certain programs could be established under Federal law without necessitating the enactment of State laws.

Additional research is being conducted on the impacts of land acquisition procedures. Eminent domain laws and agency procedures used in the planning of projects; the acquisition of land; the relocations for individuals, families and businesses; and the compensation and loan assistance to rehabilitate those displaced vary widely.

One staff member served in a research capacity as Staff Economist to the U. S. House of Representatives Select Subcommittee on Real Property Acquisition for approximately half of fiscal year 1964 and part of 1965. Personnel also served on the Department's Task Force on Needs of Rural Communities.

AREA NO. 3. RESOURCE TENURE INSTITUTIONS

AREA NO. 3.B. LAND TENURE

Problem. Improvements in the security, efficiency, and general well-being of rural people and others can be achieved through better tenure arrangements. At the firm level, research is needed to develop tenure devices which provide efficient, flexible, and expanding farms and rural enterprises. For guiding policies and programs, research also is needed to determine the effects of economic change on the adjustments in the relationships among resource owners and resource users and to determine the impact of various public measures on access to resources.

USDA AND COOPERATIVE PROGRAM

A continuing program of research is conducted which includes collection and analysis of data on basic land tenure changes and trends, patterns of land-ownership, forms of tenancy and other devices for resource control; analysis of the effects of leasing and other tenure arrangements on efficiency, scale of operation, investments, and the distribution of costs and returns; and analysis of the nature, relationships, and economic implications of changes in conditions under which farm and other land is acquired, held, and transferred. Consideration is given to the economic implications of land tenure arrangements and to the legal and institutional framework within which such arrangements operate. Much of the program is carried out cooperatively with the Agricultural Experiment Stations in several States and with Puerto Rico; the Agricultural Law Center, State University of Iowa; and with the regional research committees in the Great Plains, North Central, and Southern States.

The total professional man-years currently devoted to the area is at the rate of 5.0 man-years.

PROGRAM OF STATE EXPERIMENT STATIONS

Research in this area deals with the problems which young people encounter in getting established in farming, the educational needs of beginning farmers, what arrangements older farmers make for intergeneration transfer of the farm, tenure systems best suited to the ever increasing capital requirements in farming, and to what extent prevailing systems of tenure retard or facilitate adjustments to new technology and in obtaining optimum production efficiency.

In the North Central States special attention is given to determining the number of farming opportunities which may become available in some future period like 1980 in relation to the number of young people who may wish to farm. In the same regional project other States are studying the land contract as a means for acquiring a farm with low initial capital. Others are studying corporate ownership as a way in which to obtain operating

control over land and maintaining ownership continuity over time. The question is whether this may minimize the breaking up of farms for the settlement of estates.

Studies are also being made as to the goals which farmers have regarding farm rental or landownership. The extent of and practices followed in field leasing for enlargement of operations are being studied since this practice is becoming more prevalent with the use of rubber tired equipment and the shortage of land for sale in many neighborhoods.

A total of 11.0 professional man-years is devoted to this area of research.

PROGRESS - USDA AND COOPERATIVE PROGRAMS

A. Basic Information on Tenure

Work continued on the development of basic information on tenure. Two analyses of regional landownership data were completed and manuscripts prepared for publication. The first was a study of factors affecting the distribution of landownership in the Eastern Great Plains. Size of ownership units was significantly related to the present age of owner, age at first acquisition of land, and length of ownership. Additionally, the distribution was significantly related to the method by which land was acquired, and to tenure, occupation, and type of owner. The second study was a comparative analysis of white and nonwhite landownership in the Southeast. Nonwhites comprised 12 percent of all rural landowners and owned 7 percent of the land. Compared to white landowners, nonwhites were older and first acquired land at an older age, had a lower rate of land transfer, relied more heavily upon inheritance as a method of acquisition, and more frequently held land in undivided, multiple-ownership units.

Information on land tenure and use, resource organization, and institutional obstacles to land use shifts were supplied in response to inquiries from the United Nations and from the Organization for Economic Cooperation and Development.

A draft manuscript describing a tenure-size classification model was completed under cooperative research by the Oklahoma Agricultural Experiment Station. The model was developed and used in analyzing Oklahoma portions of Great Plains farm survey data. A manuscript reporting the findings is being prepared.

Work was initiated with the Bureau of Land Management, U. S. Department of Interior under an informal agreement. Specific proposals for research on public-private cooperation in land management are to be developed and covered under a Memorandum of Understanding between the two agencies. Current work consists of orientation and consultation with Bureau personnel on the programs, policies, and operations of the Bureau's Washington and field activities.

B. Analysis of Tenure Arrangements

Several activities were carried out in connection with the research on legal-economic aspects of farm tenure arrangements. Two studies, carried out in cooperation with the Agricultural Law Center of the State University of Iowa, were completed; one, dealing with Iowa farm fence law, has been published; and the other relating to land contracts is currently in process of publication. The latter study presents the status of the law in Iowa governing the use of land contracts, it emphasizes the differences between land contracts and mortgages as credit instruments and suggests model provisions for land purchase contracts. It is expected that a Farmers' Bulletin will be prepared from the analysis.

A preliminary study in cooperation with the University of Illinois, was made of the potential use of land trusts for intergeneration transfers.

The final report from a research contract with the State University of Iowa for legal-economic analysis of vertical integration and contract farming was received. The report included analysis of the law of farm contracts covering crucial elements of vertical integration contracts, a classification of 420 contracts according to the extent that entrepreneurial responsibility is transferred from the farmer to the contractor, and model contract forms for three commodities. The contract reports are being summarized and a manuscript is being prepared for publication.

As an outgrowth of the vertical integration contract study, a method for quantitative analysis of contract content was developed, and submitted for Journal publication.

Cooperative research with Iowa State University on farm corporations includes both legal and economic analysis. Separable segments of the research yet to be completed include a legal analysis of the corporate form of business organization, and legal and economic analysis of the corporate form as it is applied to farms. An article has been accepted for publication in the Kansas Law Review. The legal-economic analysis, now near completion, analyzes operation of an incorporated farm simultaneously with analysis of each shareholder's personal estate. Aspects of this research were discussed in broader context of approaches to legal-economic research in a paper presented at the annual meeting of the American Farm Economics Association.

Active participation in the North Central regional project on needed adjustments in land tenure to meet changing agricultural conditions (NC-53), has involved ERS personnel in several projects, particularly through leadership of the phase concerned with evaluation and development of new or modified tenure arrangements. Studies of specific tenure arrangements, including corporations, partnerships, leases and credit, are being completed as rapidly as possible. Projections of the structure of agriculture in the region to 1980 are being extended to the economic areas in which intensive field studies are being undertaken. Field schedules have been taken in four of the five selected economic areas and their analysis is in process.

Cooperative research on alternative approaches for owning and controlling farm resources has been initiated with Michigan State University. The study will examine the effect of leasing and alternative tenure arrangements on farm organization and capital accumulation, and will include analysis of the decision making framework for selection of ownership or various contractual alternatives available to individual farm operators.

C. Analysis of Structure of Resource Ownership and Control

Research on one study of the interrelations of tenure arrangements and production control programs in the Southeast was completed with submission of two manuscripts for publication, and another study is near completion. Publications from cooperative research with Virginia on the value of peanut allotments, reported last year, include a Virginia Agricultural Experiment Station bulletin now being printed and an article to be published in the November, 1964 issue of the Journal of Farm Economics. The article deals with problems of statistical interpretation frequently encountered with farm sales data.

An analysis of historical changes in net returns to land and to labor under the tobacco control program, being carried out cooperatively with North Carolina, is near completion. Trends in returns to land and labor from 1922 to 1960 were analyzed for a region in Virginia and one in North Carolina. In both areas, land returns increased much more than did total tobacco returns or returns to capital and labor. In the period, income from tobacco increased by more than sixfold in both areas. Labor earnings of sharecroppers increased at about the same rate. Land returns, however, increased twelvefold in Virginia and ninefold in North Carolina. For farms using hired laborers, land returns increased even more--21-fold and twelvefold, respectively, for the two regions, while hired labor returns were about fourfold, which was less than the increase in total tobacco income. The increase in cropper labor returns relative to that of hired farm workers is explained by the rigidity of tenure arrangements. However, adjustments are made by other means. From 1954 to 1959 in the sample counties, croppers declined by 48 percent, a larger drop than other tenure groups, while regular hired workers increased by 60 percent. The analysis of this study is nearly completed. A manuscript is in preparation. In the future this research will be reported under the work project, Resource Income Distribution.

A statistical analysis of proportional-profit farm records was carried out in the research on land tenure problems and policies of Puerto Rico. Records were analyzed for 7 farm projects for a 13-year period. Four projects have incurred large losses during the period, one project has shown a substantial profit, and two projects have had small profits. With a few exceptions, capital and fertilizer are being applied at a level such that the imputed return of these inputs is less than their cost. On four projects, more labor could be profitably used--on two of these projects it appears that a marginal return to labor in excess of its cost is due to the substitution of

capital for labor in greater than optimum amounts. The apparent over-application of nonland resources on the projects supports the hypothesis that maximization of total sugar output is an objective in the operation of the farms. Other research being carried out includes historical and legal study of factors contributing to the land reform in Puerto Rico and influencing the later administration of the law.

A manuscript on economic growth in Puerto Rico, reported last year, has been accepted for publication in Economic Development and Cultural Change.

Cooperative research with the University of Illinois on resource returns and tenure adjustments has consisted of formulation of a theoretical framework for analyzing factor returns and analysis of farm record data. Preliminary results indicate that a greater proportion of farm income was capitalized into land values in 1960 than in 1950. This study will contribute to NC-53, discussed under area B above. In the future this research will be reported under the work project, Resource Income Distribution.

Major activities with regional committees included development of a prospectus for research on changes in entrepreneurship in agriculture and joint-responsibility for initiating preparation of a book on land economics research methodology, for the Interregional Land Tenure Research Committee; ERS representation on the North Central Land Economics Committee and Southern Land Economics Committee, including co-responsibility for planning the SLERC Conference on Optimizing Institutions for Economic Growth; and presentation of a paper on housing and community facilities in the Canadian prairies to the Great Plains Resource Economics Committee Workshop on community development. An outgrowth of regional committee activity was the formulation of a study for development of a decision-making model for individuals' migration, being carried out under contract by the Mississippi Agricultural Experiment Station.

Several activities related to foreign land tenure problems were carried out in addition to the foreign implications of the Puerto Rico research. The more important of these activities were consultation with foreign visitors and preparation of two publications on land reform and land prices in western India.

AREA NO. 3. RESOURCE TENURE INSTITUTIONS

AREA NO. 3.B. LAND TENURE PUBLICATIONS - USDA AND COOPERATIVE PROGRAMS

A. Basic Information on Tenure

Boxley, Robert F. 1964. Owner characteristics and distribution of land ownership in the Eastern Great Plains. ERS-197. 32 p.

Munger, James A. 1964. Components of rural land values in Northern Wisconsin. Land Econ. 40(1). 87-91.

Strohbehn, Roger. 1963. Ownership of rural land in the Southeast. U. S. Dept. Agr., Agr. Econ. Rpt. 46. 43 p.

B. Analysis of Tenure Arrangements

Harl, Neil E. 1964. The farm and ranch corporation -- business organizational form of the future. Nebr. Law Rev. 43(2). 364-381.

Hines, N. William, and Harris, Marshall. 1964. Iowa farm fence law. Agr. Law Center Monograph 4, State Univ. of Iowa. 34 p.

Hurlburt, Virgil L. 1964. Rent determination within the farm firm. In Rent Theory, Problems and Practices, North Central Reg. Res. Pub. 139. p. 5-26.

Hurlburt, Virgil L. 1964. Use of farm resources as conditioned by tenure arrangements. North Central Reg. Pub. 151. 32 p.

C. Analysis of Structure of Resource Ownership and Control

Boxley, Robert F., and Gibson, W. L., Jr. 1964. Peanut acreage allotments and farm land values. Va. Agr. Expt. Sta. Tech. Bul. 175.

Munger, James A., and Loomer, C. W. 1964. Ownership and use of land for forestry and recreation in Northern Wisconsin. Wis. Agr. Expt. Sta. Res. Bul. 248. 32 p.

Wunderlich, Gene. 1963. Land reform and land prices. Indian Jour. Agr. Econ. 18(4): 32-37.

Wunderlich, Gene. 1964. Land reform in Western India: analysis of economic impacts of tenancy legislation, 1948-63. ERS Foreign-82. 46 p.

AREA NO. 4. RESOURCE INCOME DISTRIBUTION

Problem: The economic well-being of rural people and others over time is affected by the distribution of income to the factors of production. In particular, changes in land income have major distributional effects due to the multiplication of these income changes into capital gains or losses associated with market transfer of land ownership. Public programs having benefits incident to land create capital gains to initial landowners, but these gains become increased capital requirements and additional costs of production to new generations of landowners. For guiding policies and programs of the future, research is needed on the distribution of resource income, how it has changed over time, and why; particularly, research is needed on determining the incidence of benefits and costs of ongoing public programs such as commodity and credit programs, conservation and resource development research and education, and the like.

This Investigations unit was established in September, 1964. Personnel will be assigned to the Investigation during the 1964-65 reporting year.

USDA AND COOPERATIVE PROGRAM

A description of the research being initiated is presented under Area No. 3B. Land Tenure, C. Analysis of Structure of Resource Ownership Control.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations have no research classified specifically in this area.

PROGRESS - USDA AND COOPERATIVE PROGRAMS

Progress in ongoing and past research on resource income distribution is reported under Area No. 3B. Land Tenure, C. Analysis of Structure of Resource Ownership Control.

AREA NO. 5. IMPACTS OF URBAN GROWTH ON RURAL AREAS

Problem. Growing urban demands for land to be used for non-farm purposes and decreasing demand for land used in agricultural production cause many conflicts of interest. Research is needed to find ways whereby adjustments in land use can be made in an orderly and economic manner, and the deleterious effects of urban growth on rural economies minimized.

USDA AND COOPERATIVE PROGRAM

Research on urban impacts is divided into two subareas: Studies under subarea (A), land use changes on the rural-urban fringe, are made to show the results of rapid urbanization on nonagricultural demand for land, ways to reduce the impact on agricultural activities, and to project the effects of future demands on the land resources. Studies under subarea (B), outdoor recreation, are made to determine characteristics of demand, area and kinds of land needed for various kinds of recreation, and factors involved in public or private ownership and management of land for recreation.

Information is drawn from several disciplines in addition to economics. Formal research cooperation with the University of Delaware was discontinued, although two unfinished manuscripts are being completed on an informal basis. Informal cooperation is maintained with many governmental agencies, State experiment stations, and other organizations.

Approximately 2.0 professional man-years were devoted to the program on the urban impacts on land use, of which 0.3 was detailed to the Federal Reconstruction and Development Planning Commission for Alaska.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations only recently have given much emphasis to land problems near urban areas or resulting from the encroachment of the suburbs into rural areas. Studies underway deal with the extent to which urban influences cause land prices to rise above agricultural values and the rate at which urban land use moves into the country. Other studies analyze the use which rural residents make of open land and how the concept of part-time farming may satisfy the need for open space. The effect of highway improvement on land use and community development is also being studied.

Total professional man years involved is 1.0.

PROGRESS --USDA AND COOPERATIVE PROGRAMS

A. Land-Use Adjustments on the Rural-Urban Fringe

A study on rural residential subdivisions serving the Washington, D. C. area in 1963 was completed. The demand for this kind of land use usually is from urban people who want family-oriented recreation in a rural setting. Suggestions to prospective buyers, subdivision developers, and public officials were developed from answers to the questionnaires.

A proposal by the Joint Open-Space Project Committee of the National Capital Regional Planning Council for a study of ways to maintain agriculture in the rural fringe of the Washington, D. C., metropolitan area has been under review during the year.

Two manuscripts based on the urban fringe studies at the University of Delaware were reviewed during the year. One, an analysis of land subdivision for suburban housing in northern Delaware, traces recent subdivision growth and discusses the growth of population, need for expanding urban areas, and the availability of rural land for suburban development as causes of urban expansion. The historical pattern of manufacture and trade, transportation, developed sewage disposal systems, and the evolution of planning in the area superimposed on the soils and agriculture affected the pattern of subdivision. Location of sewer lines probably has been the most important single factor in recent years. This cooperative report will be published by the University of Delaware.

A second manuscript entitled "In Search of Policy Criteria for Open Space Preservation" was approved for publication in a journal. This paper, reviews certain standards used for planning areas for parks and other open space uses, questions their adequacy under present and future demand for open spaces in and near urban areas, and urges that adequate standards be developed to aid the large land use planning programs currently being carried out.

A report based on the study and use of aerial photography over a number of years is being prepared to demonstrate and explain the usefulness of aerial photography as a tool for economic and land use planning in metropolitan and urban fringe areas. This report will be of use to State, regional, city, and county planners who must decide the best way to make maps, conduct land-use and cover studies, and accomplish other planning-oriented work.

A paper about the situation of the aging in urban fringe areas showed that, although few programs are developed to utilize their capabilities, many elderly, retired, or semi-retired people can provide valuable services to the newly developed communities. Large parts of the urban fringe are social and economic deserts caught between levels of economic uses. Urbanization has made the land unattractive for continued agricultural use before the need for urban uses has developed. Relatively few elderly

people are indispensable because of their special capabilities, yet the elderly often can help bridge the gap between generations by sharing their experiences and interests with younger people. The paper relates values from older modes of life to present situations. The need for promoting values of "community" where urban and rural cultural forces meet are discussed.

B. Outdoor Recreation

A 1962 study of vacation farms in East Central Ohio (ERS-113) was supplemented by a followup study in 1963. A study of farm vacation facilities in New England was completed. Both studies show that, although most farm families make very modest incomes from this work, they consider the activity worthwhile because of the pleasure they get from meeting the people on vacation. The income earned from the farm vacation work generally pays taxes, helps pay family living expenses, or buys some new household equipment.

Considerable service was provided to individuals and agencies. Two papers for symposia and graduate seminars were prepared.

An assignment to represent the USDA on the technical staff of the Federal Reconstruction and Development Planning Commission for Alaska required approximately three months of time by the investigation leader. Special reports relative to economic conditions and resource use in Alaska were prepared during this assignment.

AREA NO. 5. IMPACTS OF URBAN GROWTH ON RURAL AREAS

PUBLICATIONS--USDA AND COOPERATIVE PROGRAMS

A. Land-Use Adjustments on the Rural-Urban Fringe

Johnson, Hugh A. 1964. Rural residential recreation subdivisions serving the Washington, D. C. area, 1963. AER No. 59. 31 pp.

Johnson, Hugh A. 1964. Aging in the urban fringe. Proc. Thirteenth Ann. So. Conf. on Gerontology, U. of Fla., Gainesville, pp. 23-33.

B. Outdoor Recreation

Davis, Jeanne M. 1964. Farm vacation enterprises in Ohio. ERS-164. 36 pp.

Davis, Jeanne M. 1964. New England farm vacation businesses: characteristics and owners' experiences. AER-60. 20 pp.

AREA NO. 6. ECONOMIC DEVELOPMENT PROBLEMS AND PROGRAMS IN RURAL AREAS

Problem. The incomes of many rural people are not increasing as rapidly as the national average. In addition to lower personal or family incomes, many rural residents lack public services comparable to those available to other citizens. Numerous public programs have been devised to cope with this problem. There is a need to know more about the conditions accounting for differential levels of economic development among geographic areas and to evaluate public programs and other measures to stimulate economic development and to assist local efforts to upgrade public services and employment opportunities.

USDA AND COOPERATIVE PROGRAM

The research program comprises two subareas: (A) Economic development and adjustment problems; and (B) Evaluation of Proposed Rural Development Programs. Research is concerned with determining the nature of the economic potential of areas and related local levels and trends in regional and national economic growth, and evaluating programs at the various levels of government for stimulating economic growth. Research is principally applied, but partly basic.

In Washington, D. C., the work involves development of methodology, analysis of secondary data, coordination of local area studies and the development of principles. Appraisals, guidelines and other forms of technical assistance are provided in published reports, in memoranda and in conference for those concerned with the development and administration of public programs. Local studies are conducted usually in cooperation with State experiment stations to determine the nature of the problem, to measure progress in economic development, and to evaluate the factors associated with that progress.

In West Virginia, Virginia and New York, studies are underway of the characteristics and levels of income of rural farm families in low-income areas and related resource adjustment possibilities. In Missouri, the employment potential of various industries in the Ozarks is being studied, particularly the recreation and wood products industries. A Michigan study concerns the ability of farmers to compete for nonfarm jobs. In Indiana, studies consider: (1) how training and education can help rural youth to enlarge their job opportunities and (2) the potential for development of rural recreation businesses. For Ohio, Kentucky and West Virginia, a study is appraising the economic opportunities for outdoor recreation enterprises on farms.

In Arkansas, Kentucky, Mississippi, Oklahoma, South Carolina and West Virginia, studies concern the economic impact on local economies of Area Redevelopment Administration grants and loans and provide information of value in program administration. In Arkansas, Iowa and Florida, studies are being made of the economic status and potential of counties designated under the Rural Renewal Program to assist program administrators and local leaders.

The research in Arkansas, Indiana, Michigan, Missouri, Mississippi, New York, Ohio, South Carolina, Virginia and West Virginia is in formal cooperation with the State agricultural experiment stations.

About 13.0 professional man-years are devoted to this area of research.

PROGRAM OF STATE EXPERIMENT STATIONS

Research in this area is an effort to find out what basic factors cause a differential rate of economic growth as evidenced by the differences between various communities within a State. Also being assessed is the effect of industrial development upon farm income. The objective in these studies is to develop basic principles which will be useful in the formulation of public rural development programs. The task is to identify the forces affecting rural resource development, the effect of these forces on levels of employment and income for alternative combinations and utilization of the available resources, and the affect of specific resource development programs on employment and income.

Total professional man-years in this area is 2.0.

PROGRESS - USDA AND COOPERATIVE PROGRAMS

A. Economic Development and Adjustment Problems

A study of two labor markets in Michigan revealed that farmers over 30 years of age seldom move outside the community. Full-time farmers have increasing difficulty in finding nonfarm jobs after 30 years of age and experience extreme difficulty after 45. It also indicated that more than two-thirds of the part-time farmers, who hold full-time off-farm jobs, plan to continue to farm even though they are well established in nonfarm work. Two manuscripts have been approved for publication and one is in clearance.

A study of training and education as a means of providing more job opportunities indicated that a large proportion of young adults in a low income rural area of Indiana have potentials to benefit from on the job training and many have potentials to reach relatively high skill levels. However, high school students score well below high school graduates throughout the U. S. Even in low income areas, level of earnings increased and unemployment decreased as level of education increased. Preliminary analysis indicates that the adult population is not motivated to move to other areas or other jobs.

Data collection has been completed for the study of the dynamics of physical and human resource use in selected low-income areas of West Virginia, Virginia and New York. Analysis is in progress.

In the study of preferences for recreation among facility users, data are being collected from boat owners, hunters and fishermen in southern Indiana and north central Kentucky. Experience and preference data have also been collected from campers in Indiana.

B. Evaluation of Proposed Rural Development Programs

Data from 800 households in southern Ohio, northeastern Kentucky and northern West Virginia have been collected to determine the demand for outdoor recreation facilities and services.

A study of potential employment in the Missouri Ozarks revealed that the wood using industries employed 10,837 people in 1960, equivalent to 7,100 full-time workers. By 1975, the value of wood products is expected to increase 20 percent, and the number of full-time workers to 8,500. In 1959, there were 39,000 farms. Projection of present trends would result in more extensive enterprises and further farm consolidation. The 1975 projected resource base would support 18,000 farms with net incomes averaging \$2,000 or 9,191 with net incomes averaging \$4,000.

Studies of six selected ARA projects in Arkansas, Kentucky, Mississippi, Oklahoma, South Carolina and West Virginia are underway to establish benchmark information including income, employment, investment, business and farm activities, for evaluating economic changes associated with these projects, to appraise the short-run impact of development projects on the economy of these areas, to provide information to administrators of Federal and State programs for evaluation of progress and appraisal of various means of development of local areas, and to evaluate the multiplicative effects of ARA projects on local economies. The estimated number of full-time jobs per \$10,000 of ARA funds for the first operating year of the above projects will range from about 1 to 55. Two progress reports have been made.

Economic analyses to facilitate the Rural Renewal Program are underway in Little River County, Arkansas, Monroe and Appanoose Counties, Iowa, and Holmes, Walton, and Washington Counties, Florida. Reports for each area study will include (1) an inventory of human and natural resources of specific renewal areas; (2) other base data as needed, such as comparable State data and historic data identifying significant trends; (3) an assessment of the economic potential of the area with and without the Rural Renewal Program. In addition, interim appraisals of facets of the program are provided for the FHA, for example, an assessment of the employment potential of recreation alternatives in Little River County. The major goal of the Rural Renewal Program is encouraging the adaptation of all rural land to its best use. Means of attaining this goal include purchase and resale of land to enlarge family farms, to provide cooperative woodlots, to upgrade rural housing and to make land available for nonfarm uses consistent with the overall rural renewal plan approved for that area. Funds for these activities include FHA loans to authorized local public agencies and FHA payments for technical assistance.

AREA NO. 6. ECONOMIC DEVELOPMENT PROBLEMS AND
PROGRAMS IN RURAL AREAS

PUBLICATIONS - USDA AND COOPERATIVE PROGRAMS

B. Evaluation of Proposed Rural Development Programs

Bird, Ronald and McNabb, Coy G., 1963. Economic Importance of Tourists to the Missouri Ozarks, Mo. Ext. Cir. 774. 12 pp.

Bird, Ronald, 1963. Income Potential of Various Kinds of Farm Recreational Enterprises in Missouri, Mo. Agr. Expt. Sta. Bul. 783. 36 pp.

Owens, Gerald P., 1964. Income Potentials from Outdoor Recreation Enterprises in Rural Areas in Ohio. Ohio Agr. Expt. Sta. Res. Bul. 964. 52 pp.

AREA NO. 7. INCOMES, EMPLOYMENT AND RESOURCES OF PEOPLE IN SELECTED RURAL AREAS

Problem. Rural people, particularly rural farm people, bear a disproportionate share of the low-income problems of the Nation and are confronted with difficult adjustments in resource use. Rural people are not, however, a homogeneous population with respect to either present levels of income and economic development or the nature of possible and desirable adjustments in the use of resources.

There is increasing need for research designed to develop and organize data into analytically functional patterns indicative of the interrelationships between income levels and measurable characteristics of the human agent and other resources by economic activity sectors and geographic areas; and analyses to discern particular relationships that have significant implications for policies and programs designed to facilitate resource adjustments and ameliorate underemployment and low incomes.

USDA AND COOPERATIVE PROGRAM

The research program on the general problem is principally applied, although particular segments may be considered basic. The program is conducted both in Washington and at field locations in cooperation with the Mississippi, North Carolina, and Oregon Agricultural Experiment Stations and with Southern University and A. & M. College. The principal efforts are: To develop and organize data concerning incomes and resources of rural people and areas in patterns or classifications, the analyses of which will shed light on the interrelationships existing between income levels and the nature and utilization of resources for economic activity sectors; and to develop and test methodology and measurement techniques for quantifying observed or hypothesized relationships between income levels, changes in income over time, and specified characteristics and uses of resources.

During the reporting period 8.0 man-years of professional time were devoted to this area of research.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations have no research classified specifically in this area.

PROGRESS - USDA AND COOPERATIVE PROGRAMS

Research has continued concerning the concept and measurement of involuntary economic underemployment. A procedure has been developed for making estimates of the unemployed equivalent of economic underemployment additive with existing estimates of unemployment as conventionally defined. It was found that in 1959 there were among employed rural persons between 20 and 64 years of age a little more than 2.2 million man equivalents of unemployment resulting from economic underemployment. In contrast, there was an annual average of only 816 thousand unemployed, as conventionally defined, among this population in 1959.

Employing the concept of economic underemployment, estimates have been made of the extent of maladjustment of labor on economic classes of farms by subareas for the States of Iowa, Indiana, Arkansas, and North Carolina.

A study of poverty in rural areas of the United States revealed that, in 1959, some 17.4 million rural people were living in poverty--almost 16 million in rural families with incomes less than \$3,000 and nearly 1.6 million unrelated individuals with incomes of less than \$1,500. Of the 16 million people in families, 10 million were rural nonfarm residents and 6 million lived on farms. Poor whites in rural areas numbered over 12 million, compared to less than 4 million Negroes, and 250,000 American Indians. The families of hired farm workers, domestic migratory farm workers, and sharecroppers are among the chronically poor. These families, along with other poor rural farm families are concentrated in the southern part of the country, but are also plentiful elsewhere.

A study utilizing a matched sample of Census of Population and Housing and Census of Agriculture questionnaires has developed data showing income distributions, population characteristics, and housing conditions for farm operator households by economic class of farm.

Since level of educational attainment is one of the more important factors affecting income earning capacity, a study has been made to determine the facts concerning the educational attainment and aspiration of youth in farm operator families. The level of aspiration as measured by proportion planning training beyond high school is lower than that for nonfarm youth. It is probable, however, that this is a result of the higher incidence of low family incomes among farm operators. Youths who see no possibility financially of undertaking training beyond high school are not likely to indicate plans for such training.

In a study of rural residents in the Willamette Valley, a low income area of Oregon, only 38 percent received income from farming and less than half of the farmers depended primarily on farming. Most farmers with off-farm work, consider the jobs permanent. Among those relying primarily on farming, many had family members who worked off the farm. Almost all farmers liked the farm and expected to still live there in five years.

AREA NO. 7. INCOMES, EMPLOYMENT AND RESOURCES
OF PEOPLE IN SELECTED RURAL AREAS

PUBLICATIONS - USDA AND COOPERATIVE PROGRAMS

Moore, E. J., Baum, E. L., and Glasgow, R. B. 1964. Economic Factors Influencing Educational Attainments and Aspirations of Farm Youth, AER No. 51, USDA. 43 pp.

Haren, Claude C. and Glasgow, Robert B. 1964. Median Family Income and Related Data by Counties, Statistical Bulletin No. 339, USDA.

Holmes, O. Wendell, Jr. 1964. Private Outdoor Recreation Facilities in Rural Areas of Western Oregon, Special Report 173, Oregon Agr. Expt. Sta. 27 pp.

Bird, Alan R. 1964. Poverty in Rural Areas of the United States, AER _____, USDA. 70 pp.

Glasgow, Robert B. and Baum, E. L. 1963. Considerations For Planning Economic Development of Rural Areas. Journal of Farm Economics Vol. 45. No. 5. pp. 1083-1090.

AREA NO. 8. RURAL AREA ECONOMIC STRUCTURE AND ECONOMIC GROWTH

Problem. The income and welfare position of rural areas is increasingly dependent upon the interrelationships of agriculture and the other sectors of the economy. In the process of economic growth the economic structure of rural areas is continually changing, as is the relationship between rural and urban areas. Increased knowledge of the interrelationships of the structural characteristics of the rural economy, rural-urban interdependence, and economic growth are of vital importance for policy and program decisions. There is a need to explore these interrelationships and appraise development program alternatives with a view to maximizing the income and welfare position of rural areas.

USDA AND COOPERATIVE PROGRAM

The program of research may be subdivided into two subareas: (A) Intersector relationships; and (B) Appraisal of growth potentials. Although substantial segments of the program of work may be considered basic research, the results have immediate implications for guiding adjustment and development programs. Investigations analyze the basic intersector (industrial and spatial) relationships and growth potentials of non-metropolitan areas. Some effort is also directed toward development of analytical methodologies and integration of basic structural data.

Work in Washington, D. C. is concerned primarily with the development of analytical methodologies, the development of integrated structural data, and the analysis of secondary data to determine functional spatial relationships and interindustrial relations. Research at West Virginia deals with the effect of investment in agriculture, forestry, public facilities and human resources on development potential in Appalachia. In Pennsylvania investigations concern the spatial structure of employment, unemployment and income of the Appalachian region. In South Carolina work is under way to evaluate alternative development opportunities in that area.

The research in Pennsylvania, South Carolina and West Virginia is in formal cooperation with the State agricultural experiment stations.

At present, 6.0 professional man-years are devoted to this area of research.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations have no research classified specifically in this area.

PROGRESS - USDA AND COOPERATIVE PROGRAMS

A. Intersector Relationships

Personnel at West Virginia are completing an inventory of Appalachian population, labor force, and economic activity, and analysis of trends during the 1950-60 decade. This work will help identify problems and opportunities confronting the people of the region, and serve as a take-off point for developing subsequent regional studies.

A draft report has been completed summarizing a Pennsylvania study of the interrelationships between employment, unemployment and income of the Appalachian region and of 58 subareas. The research determined that subareas with small-size central places generally had a greater percentage of low-income families and a higher level of unemployment; a greater number of low-income families and unemployed workers, however, resided in subareas with cities having populations of 100,000 or more. Growth trends during the 1950-60 decade indicated that the larger and more border subareas of the region may have greater opportunity for economic growth because of their relatively smaller commitment to the declining industries of agriculture and mining and their access to non-Appalachian markets.

A study was initiated late in the year to delineate a national system of functional economic areas located around centers of economic activity with a major goal of associating all rural areas with their respective functional economic centers.

B. Appraisal of Growth Potentials

An economic analysis of farm outdoor recreation enterprises in South Carolina indicated a limited potential for development. The best opportunities appeared to be (a) specialized enterprises catering to hunters and fishermen from urban areas both within and outside the State, and (b) enterprises providing services and recreational diversions for tourists en route to and from other areas.

For another South Carolina study two low-income rural areas have been selected for economic evaluation of alternative development opportunities.

At West Virginia data are being developed to determine the relationship between local government expenditures for public facilities in Appalachia and the potentials for economic development.

A study which examined the agricultural, forestry and human resource development alternatives of West Virginia indicated that the allocation of insufficient resources to human resource development may preclude the achievement of maximum improvement in the economic welfare of the Appalachian people.

The planning model developed under contract with Stanford Research Institute has been completed and empirical testing has been conducted with south central Kentucky data. Further use of the model will endeavor to determine development potentials of Appalachian subareas and the structure of economic expansion most efficient in obtaining desired rates of economic growth and least requiring of capital importation.

Another contract project with Stanford Research Institute provides for analyzing employment trends in sixty Standard Industrial Classification 4-digit manufacturing growth industries and will endeavor to develop a procedure for selection of industries suitable for development in rural areas.

AREA NO. 8. RURAL AREA ECONOMIC STRUCTURE AND
ECONOMIC GROWTH

PUBLICATIONS - USDA AND COOPERATIVE PROGRAMS

A. Intersector Relationships

Pavlick, A. L. and Coltrane, R. I. 1964. Quality of Rural and Urban Housing in the Appalachian Region, USDA, AER-52. 25 pp.

B. Appraisal of Growth Potentials

Branch Staff paper, 1963. The Appalachian Region's Agriculture: Its Problems and Potentials for Development, prepared for the President's Appalachian Regional Commission. 107 pp. plus table and appendix.

Glasgow, R. B. and Baum, E. L. 1963. Considerations for Planning Economic Development of Rural Areas, Journal of Farm Economics, 45: 1083-90.

McElveen, Jackson V. 1964. Farm Outdoor Recreation Enterprises in South Carolina, South Carolina Agr. Expt. Sta. AE 263. 48 p.

AREA NO. 9. ECONOMIC FRAMEWORK AND CRITERIA
FOR RIVER BASIN AND WATERSHED DEVELOPMENT

Problem. The Senate Select Committee on National Water Resources in its report of January 1961, recommended the development of comprehensive plans for all major river basins by 1970. Formulation of comprehensive plans for use and development of river basins requires the establishment of an adequate framework of economic data, projections, and systems of analysis; and the application of appropriate evaluation standards and concepts. Such considerations as the large capital investments being made by public agencies in water-resource projects, the pressure of an expanding economy on the available resources, existing underemployment of resources, the need for production and income stabilization and advancing technology, emphasize the need for economically sound comprehensive river basin plans.

Future use and investment in the development of water and related land resources should be shaped by regional and national considerations as well as local needs and desires. To achieve these objectives, economic research is required to relate the potentials of various basins and their relative economic efficiency to emerging national and regional requirements and goals. Furthermore, continuous reappraisal is required to evaluate the changing pattern of technological development and consumer preference, and to relate these changes to the potential supply and demand of natural resources.

USDA AND COOPERATIVE PROGRAM

Current activities are concerned with these subareas of investigations: (A) Standards and practices for economic evaluation and program formulation; (B) interregional analysis and projections of the agricultural economic activity and resource use; and (C) river basin needs, problems, patterns of resource use and potential for development. These activities provide a basis for the evaluation of agricultural elements of a river basin's economy within the framework of national requirements and production prospects. Although basic research is undertaken, program emphasis is on applied research. The research is carried out through five field offices and in Washington, D. C. The field locations are, Little Rock, Arkansas; Stillwater, Oklahoma; East Lansing, Michigan; Upper Darby, Pennsylvania; and Logan, Utah.

The investigations activities are carried out under provisions of a Memorandum of Understanding, between the Soil Conservation Service, Forest Service, and Economic Research Service, and through cooperative agreements with the Corps of Engineers, Public Health Service, and other public agencies. Activities are financed through transfer funds from these agencies.

A total of 11 professional man-years is devoted to the overall investigations.

PROGRAM OF STATE EXPERIMENT STATIONS

Research in this area is primarily that of establishing benchmarks from which to measure progress resulting from the small watershed programs. The present situation with respect to resource development is carefully recorded and analyzed and at periodic future dates the area is studied again so as to assess the effects of certain basic programs. Significant items are the progress in converting land from intensive to extensive use or vice versa, change brought about by reduction in flooding, trends in real estate prices, and the value of recreational development resulting from the concept of multiple use.

A total of 2 professional man-years was devoted to this area of research.

PROGRESS-USDA AND COOPERATIVE PROGRAMS

A. General Standards and Practices for Economic Evaluation and Program Formulation

Work continued on the development of improved evaluation and formulation standards and practices for water resource programs through participation on inter and intra-Departmental task groups. Activities of these groups resulted in the preparation of "Evaluation Standards for Primary Outdoor Recreation Benefits," June 1964, which is Supplement No. 1 to Senate Document No. 97. The supplement provides guidelines and standards for the evaluation of recreation benefits associated directly with the use by outdoor recreationists of services made available by resource development projects; the standards are also applicable to the measurement of project effects upon those recreational activities associated with changes in the regimen of streams or water bodies beyond the project area and land based recreation activities affected by the project.

B. Interregional Analysis and Projections of the Agricultural Economic Activity and Resource Use

A study which establishes current normalized agricultural production data and price relationships was completed. This study involved the transferring of crop and production data to magnetic tape for 80 commodities from 1939 to 1963, by States. Using a series of computer programs, tabular printouts were prepared for each State by commodity, showing acreages (numbers for livestock) yield, production, percent of U.S. production, price and value of output. Graphs were derived for each State by commodity, showing the observed values and a computed trend line for the acreage, yield, production, price and value of output. The computed values provided the basis for current normalized estimates of the selected factors for each commodity by State. Abnormalities caused by weather and other hazards for a production period were thus removed by this technique. The normalized

factors also reflect current production practices and current technology.

The Branch staff, along with other ERS personnel, is also participating with the Office of Business Economics (OBE), Department of Commerce, in a program of Economic and Statistical Analysis and Projections for Comprehensive River Basin Studies. The program was developed by the Interdepartmental Staff Committee representing the Secretaries of Agriculture; Army; Health, Education and Welfare; and Interior. The purpose of the combined effort of OBE and ERS is to develop current data and 50-year projections for 16 specified geographic areas of the Nation. These data and projections will provide a partial basis for estimating the needs for, and value of, potential water and related land resource developments.

Projections are being made for (1) volume of agricultural output by product groups, (2) agricultural and forestry employment and income, (3) the use of rural lands, including acreages devoted to major crops, and (4) employment, income, and other measures of economic activity directly and locationally related to the basic agricultural and forest industries.

In addition, an agricultural data bank is being developed under the program to provide for the tabulation, analysis and updating of pertinent data about agriculture, land use and rural economies currently available for all counties of the Nation. When completed, the data bank will include rapidly retrievable statistical information which will be used in framework studies and in detailed planning studies of subbasins.

Estimates of regional requirements for agricultural products through 1980 have been developed in cooperation with the Economic and Statistical Analysis Division of ERS. The projection of national food and fiber requirements are based upon specific assumptions with regard to such factors as population growth, consumer income, consumer preferences, exports and imports, and per capita consumption. National requirements were allocated to 10 regions based upon such factors as historical contribution of regions to the total agricultural product requirement, and losses or gains in the resource base of regions. Simultaneous allocations of the national requirements to regions establishes estimates of regional product requirements which are consistent with the national food and fiber needs.

C. River Basin Needs, Problems, Patterns of Resource Use and Potential for Development

Basic objectives in the formulation of framework plans is to provide a broad guide to the best use, or combination of uses, of water and related land resources of a region to meet foreseeable short and long-term needs. Three such investigations are underway at the present time--the Ohio, Upper Mississippi, and Missouri River Basins. Thirteen additional investigations will be undertaken as funds are made available.

Intermediate objectives for the agricultural portion of the Ohio River economic base study were attained. Estimates of the future agricultural activity in the Ohio River Basin and subbasin for 1980 through 2010 with special reference to required irrigation, drainage, and floodplain development needs were completed. Major accomplishments were, (1) inventory and classification of land available for agricultural use--acreage, intensity of use, systems of management, levels of output, production practices and costs; (2) projections of future market requirements for agricultural products for 1980 and 2010 based upon assumed rate of population growth, increasing levels of productivity and income and expected patterns of consumers preference; and an allocation of national needs to the Ohio Basin based upon analysis of current trends, expected shifts between regions in production advantages and availability of natural resources for agricultural use; (3) projections of availability of land for agricultural use by 1980 and 2010, including projections of urban, industrial, and other nonagricultural requirements for land and expected retirement of land not suited to cultivation to less intensive use; (4) appraisal of future crop and pasture yields based upon development and application of improved production technology, further application and improvement of soil and water conservation practices, and expected intensification of crop production practices, including intensified fertilizer usage.

An analysis of the agricultural drought problem and the potential increases in output obtainable for irrigation development in the Ohio River Basin is continuing. The procedure involves an evaluation of the frequency of occurrence and production losses associated with specified levels of moisture deficiencies by soil groups (with estimated water holding capacities) and land resource areas in the basin. Precipitation records were obtained from about 270 weather stations for 1960, 1961, and 1962.

Production data by soil groups were obtained from field enumeration of farm operations within three miles of the 270 preselected weather stations. Major items covered in the survey were fertilizer inputs, production practices, yields, size and shape of field, and damage to yield, other than drought.

The data collected from the sample plots were correlated with the weather data from the weather stations. A least-squares multiple regression analysis was conducted for the purpose of estimating the influence of the established drought factors upon the yield of individual crops during 1960, 1961, and 1962 crop seasons.

Economic base studies which will estimate the future agricultural activity in the Upper Mississippi River Basin and the Missouri River Basin for 1980 and 2010 were initiated. Current activities involved cooperative endeavors with soil scientists from the various States in the basins to develop an economic classification of the soils as delineated in the Conservation Needs Inventory. Procedures are being formulated to determine the existing crop distribution, yields and fertilizer use for each soil group. Summary and

analysis of secondary data relating to the agricultural sector of the economy, including agricultural employment and rural population are being made.

An economic base survey to provide a basis for the development of a water quality management program through the evaluation of the present and past economy of the several subbasins in the Colorado River Basin and projections of its probable future growth path is being made. A guiding objective is the maximization of gross regional product net of costs associated with necessary water quality measures.

During the year, a study of the economic features of agriculture and forestry in the lower mainstem subbasin of the Colorado was completed. One of the major purposes of this study was to describe interrelationships among the various segments of the total economy. Results of the study indicate that the economic activity in the subbasin is highly dependent upon agriculture. The amount spent on agricultural services for each dollar total gross output in 1960 was estimated to be: \$.63 for citrus, \$.52 for vegetables and melons, \$.083 for cotton and \$.0074 for feed grain and forage.

It was assumed that in the target years, each dollar of total gross output in each crop producing sector would require the same expenditure on agricultural services as was required in 1960. The projected future purchases of agricultural services in 1965, 1980, and 2010 were estimated to increase by about 45 percent, 175 percent, and 375 percent over the 1960 level.

Additional studies for the remaining four subbasins of the Colorado River Basin are in various stages of completion.

AREA NO. 10. RIVER BASIN DEVELOPMENT INVESTIGATIONS

Problem. Water supplies in many regions are either inadequate or imbalanced, resulting in severe competition and a need for its allocation among competitive uses. In some areas, excessive surface flows result in damage to crops, agricultural and nonagricultural buildings, and municipal and industrial installations. Population growth and the enlargement of our industries have contributed to pollution of surface and ground water supplies. The population expansion also creates a demand for land and water for recreational uses. Increasingly serious water management problems give rise to the need for continuing economic studies to identify advantageous allocation and patterns of efficient resource use, and hence to guide short and long-term development of land and water resources. Efficiency in the development and use of natural resources has a positive influence on local and regional well-being and national goals for continuing economic growth. Analysis of resource use and development potentials within this context requires basic data to identify significant relationships between land and water problems and economic growth and to determine the benefits and costs of alternative programs for the alleviation of these problems.

USDA AND COOPERATIVE PROGRAM

Current investigations are concerned with the economic appraisal of alternative patterns and schedules of agricultural resource development; participation in river basin and subbasin plan formulation; and the economic review of Federal agency reports on water resource development proposals. Studies are concerned with the development and adaptation of systems of analysis and methodology required to identify optimal and balanced patterns of land and water resource use and schedules of development for agricultural and related purposes. River basin and project plans are analyzed with respect to the agricultural economy and overall regional economic development.

A major portion of the investigations is identified as applied economic research. Closely coordinated with going USDA water and related land resources planning efforts, research at field locations is cooperative with the Soil Conservation Service and the Forest Service. Cooperative investigations of specific water resource development proposals and problems are also undertaken with State water resource agencies, the Corps of Engineers, the Public Health Service and other public agencies.

Approximately 20 Federal professional man-years are currently devoted to the overall research program.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations have no research classified specifically in this area.

PROGRESS-USDA AND COOPERATIVE PROGRAMS

A. Economic Appraisal of Alternative Patterns and Schedules of Agricultural Resource Development

During the year, work was continued on the development and refinement of a system of analysis which will identify patterns of resource use and development for achieving specified levels of agricultural production at minimum cost. Drawing on the technique of linear programming, the analytical system permits an evaluation of the economic significance of designated additions, subtractions, or quality changes in the agricultural resource base for given projections of future agricultural product requirements on a basinwide or regional basis. The system enables the resource analyst to take account of major forces affecting the supply and demand of natural resources for agricultural purposes. The system specifies land use, cropping patterns, marginal cost for each commodity group, and total cost for each set of designated conditions. It provides a systematic basis for appraising future needs for resource development, and will identify the long-range regional efficiency gains and/or losses attributable to a given program.

A mathematical program was also developed to obtain a measure of the "population potential" at any location, given latitude, longitude, and population of cities and towns. Still tentative and subject to revision, the program will be used to assess the ability of the population variable--which is a measure of remote population masses--in an attempt to explain the use of recreation areas.

B. Participation in River Basin Plan Formulation

During the year, major effort was devoted to continuing economic studies of agricultural and rural community water problems and needs for water resource development in various river basins throughout the country.

The comprehensive economic study of the New England Region is a reasonably typical example of these kinds of studies. The objective of this study, which is underway in cooperation with USDA agencies, the Corps of Engineers, and the Arthur D. Little Company of Cambridge, Massachusetts, is to assist in the preparation of comprehensive and coordinated basin and subbasin plans for separate water resources development of the Connecticut and St. John River Basins.

Major responsibilities of ERS in the overall study include an analysis of the region's agricultural economy; the preparation of agricultural production and employment projections for 1980, 2000, and 2020; and the determination of agricultural and other rural water requirements, both present and projected in cooperation with the Soil Conservation and the Forest Service.

Analysis of the agricultural economy of the six-State New England region is near completion. The analysis gives emphasis to interregional competition with other production regions in the United States; and to both the supply and quality of water for multipurpose resource development. Two integrated studies were completed. In combination, these provide an economic profile and analysis of regional agricultural resources and production, including projection of production and employment trends through 2020 by region and State. The analysis indicates that the dominant--and increasing--regional agricultural enterprise will continue to be dairy production for expanding metropolitan markets. Milk production is projected to increase by over 50 percent by 1980, nearly double by the year 2000, and more than double by 2020. Vermont is expected to increase its share of the New England total; Maine and New Hampshire are projected to maintain their share, while the three southern New England States register a decline in their share. Production of red meats closely parallels milk production since it is largely cull dairy animals. Potato production is concentrated in Maine and this area is expected to become even more important in the future.

Agricultural labor requirements in the future were estimated to continue a very gradual decline when expressed as man-year equivalents. Farm employment equivalents for the year 2020 were projected at 59 thousand man-years, despite expectations of absolute increases in production. Employment projections included an allowance for shorter farm working hours and longer vacations in the future.

Overall, the analysis clearly indicates that New England agriculture has been going through a period of adjustment in the last 10 to 15 years, and this is expected to continue at least for the next 10 to 20 years. Much of this adjustment is the dropping out of small farms that can no longer compete. The proportion of national production coming from New England has been in constant decline. This proportion of national output is projected to continue to decline, but, as the result of increased demand from an expanding population, this may result in an increase in absolute production even though the relative proportion is declining.

At present, work is progressing in the breakdown of state data and projections into substate groupings by selected counties, with particular attention to analysis of present and likely future land and water needs in the Connecticut and St. John River Basins.

The Chesapeake-Susquehanna Basin studies, in cooperation with the Public Health Service, the Corps of Engineers, and the National Planning Association, are also representative of ERS participation in river basin plan formulation.

For these studies, basin projections of rural farm and nonfarm population, agricultural employment, and agricultural income were prepared. Field personnel also worked closely with Pennsylvania State University in developing projections of crop yields and fertilizer application for major soil

groups in the combined basins. Following this, budgets were constructed projecting the costs of producing field crops for each soil group, based upon the projected crop yields and fertilizer use. An equilibrium linear programming model for use in estimating the pattern of agricultural land use and cost of producing agricultural commodities under alternative assumptions of resource development also was prepared. Additionally, projected milk requirements were developed for areas traditionally supplied by farmers in the Susquehanna River Basin. These include the New York-Northern New Jersey, Philadelphia, Wilmington, Upper Chesapeake Bay, and Washington, D.C. Federal milk marketing areas. Two preliminary reports on the agricultural elements in the economic base of each basin were completed. These reports provide a profile and analysis of present agricultural organization and production in the combined areas, including the examination of significant agricultural trends and projections through the year 2020.

Basin and subbasin studies similar in scope and intensity to the Connecticut-St. John and Chesapeake-Susquehanna River Basin studies are in process, including the Willamette River and related Oregon subbasins, the Sevier, the Humboldt, Colorado, and James River Basins in the western states; the Big Blue, Elkhorn, and Meramec River Basins in the mid-west; the Pearl, Big Black, Pascagoula, Tombigbee, Red, and Poteau River Basins in the southeast; the Florida West Coast Tributaries Basins; and the Genesee River Basin in New York State. Although compelling land and water problems are pervasive in all of these basins and subbasins, these vary by type, magnitude, and effect upon economic activities and resource use. For all these ongoing studies, data collection, analyses, and projections of land and water needs are in various stages of completion. Preliminary reports have been issued for some basins and subbasins.

Several new studies were initiated during the reporting year, including the Kanawha River Basin, West Virginia; the Wabash and Big Muddy River Basins in the mid-west; the Grand River Basin in Michigan; the Sabine River Basin in Texas; the Puget Sound River Basin in Washington; and the Upper Columbia River Subbasin, Oregon and Washington. The study objectives vary among basins, but are concerned with the evaluation of some combination of the following: Floods, impaired drainage, drought, appraising effects of changing agricultural production technology, impacts of installed projects; appraising of movements by volume, source and destination of selected agricultural products and inputs, alternative means of meeting recreational demands at minimum cost, stabilization of production and income, and the identification of immediate and long-term needs and related economic evaluations necessary for plan formulation.

C. Economic Review of Federal Agency Reports on Water Resource Development Projects

Projects of the Federal Government play an important investment and management role in the field of land and water development. Public works for resource development constitute one of the major items in the Federal budget.

These include facilities for regulation and distribution of agricultural, industrial, industrial and municipal water supplies, improvement of rivers, lakes, and harbors for navigation and recreation, multiple-purpose development of river basins, flow regulation for pollution abatement and for enhancement of fish and wildlife habitat, and facilities for generation and transmission of hydroelectric power. Most of these programs embrace many problems in land and water resources, including drainage, erosion, and optimum land use. Once approved, funded, and constructed, resource development projects are likely to set patterns of land and water use for future decades. Consequently, it is important that proposed plans and projects be subject to critical review at the outset to prevent an uneconomic investment of resources in an ill-advised undertaking. Moreover, the likely changes in land and water use growing out of project installation must be reviewed for consistency with national agricultural goals and policies. The required economic evaluation of other Federal agency resource development project proposals is a continuing Branch responsibility. For each project evaluation, general and specific economic comments are prepared for inclusion in the final Department review. The review of reports is based upon the following criteria: (a) Compliance with statement of purposes and scope, objectives of planning, and planning policies and procedures set forth in Senate Document No. 97; (b) compliance with law, legislative intent, and executive policies and orders; and (c) compliance with standards for the formulation of plans and evaluation of tangible and intangible effects as set forth in Senate Document 97 and other recognized standards and practices.

AREA NO. 11. WATERSHED PROGRAM ANALYSIS

Problem. Prior to passage of the Watershed Protection and Flood Prevention Act, Public Law 566 of the 83d Congress, planning and development of small watersheds was an essentially unfilled gap in the national effort to protect and develop the nation's water and related land resources. Despite much progress in the decade since passage of PL 566, the National Inventory of Soil and Water Conservation Needs, completed in 1961, disclosed a need for project-type action by public agencies on more than 8,000 small watersheds, or 65 percent of those evaluated. These watersheds encompass some 1 billion acres, or about 55 percent of the national land area exclusive of Alaska. Participation in the PL 566 program involves evaluations of flood erosion damages and appraisals of economic returns from potential drainage, irrigation, water supply, recreation, fish and wildlife enhancement, and other purposes of land and water resource development.

Analysis for meeting planning and economic evaluation needs in support of locally initiated and locally sponsored Resource Conservation and Development Projects authorized under the Food and Agriculture Act of 1962, is a new and emergent element in the overall program. The main objective of this program is to accelerate conservation and development activities which will provide additional economic opportunities for rural people.

USDA AND COOPERATIVE PROGRAM

The program of research, basic and applied, in this area of analysis is divided into two major subareas: (a) Economic and related institutional aspects of watershed planning, development, and management, and (b) the development and improvement of economic methods and techniques in support of locally coordinated resource development projects. The program emphasizes cooperation with the Soil Conservation Service, Forest Service, and various State Experiment Stations. Major elements in the overall cooperative research program include the inventory and economic analysis of watershed work plans; appraisal of economic and institutional impacts of installed watershed projects; pilot watersheds and Washita River Basin; development of methodology and techniques for selected economic evaluations; secondary impacts of watershed resource development projects on the local, regional, and national economies; and development of planning criteria, economic standards, and analytical methodology for RC&D projects.

Program activities under PL 566 are undertaken in Washington, D.C. and in field locations at Little Rock, Arkansas; Fort Collins, Colorado; Stillwater, Oklahoma; and University Park, Pennsylvania. In Oklahoma and Pennsylvania, the research is conducted in cooperation with the respective State Experiment Stations. The program of work is provided for by a Memorandum of Agreement with the Soil Conservation Service, executed in 1955, and its composition is designed by means of annual work plans prepared cooperatively by the two Services.

Research and planning activities for approved RC&D projects are coordinated by the Washington office through five field program offices. The field locations are Little Rock, Arkansas; Stillwater, Oklahoma; East Lansing, Michigan; Upper Darby, Pennsylvania, and Logan, Utah.

A total of 13 Federal professional man-years is currently devoted to the overall research effort.

PROGRAM OF STATE EXPERIMENT STATIONS

The State stations have no research classified specifically in this area.

PROGRESS-USDA AND COOPERATIVE PROGRAMS

A. Inventory and Economic Analysis of Watershed Work Plans

By conducting an annual inventory of the basic data contained in Public Law 566 watershed work plans, the River Basin and Watershed Branch continues to accumulate a vast storehouse of pertinent facts which enables it to engage in systematic analyses of the relevant economic elements and planning phases of the watershed program. These annual inventories help to answer a large number of questions about small watersheds, such as estimated project needs, the use of land and water, types of benefits, types of costs, and estimated reduction in flood damages.

The latest inventory of basic watershed data covering national total and averages of damages, benefits, costs, and related data--some of it on a regional basis--summarizes information taken from 473 project work plans authorized for operation as of June 30, 1963. The annual inventory of basic data within groupings of watersheds having similar characteristics is of significant application in improving planning procedures for ongoing and emerging PL 566 projects.

B. Appraisal of Economic and Institutional Impacts of Installed Watershed Projects: Pilot Watersheds and Washita River Basin

1. Pilot Watersheds--Work on pilot small watershed projects derives from a 1953 appropriation by the Congress to start such work to demonstrate the feasibility of combining soil conservation measures with upstream detention structures to reduce frequent flooding. Joint ERS-SCS long-term appraisals to evaluate the effects of watershed installation improvements are conducted on seven projects, namely: Plum Creek, Kentucky; Six Mile Creek, Arkansas; East Willow Creek, Minnesota; Honey and Mule Creek, Iowa; Upper Rio Hondo, New Mexico, and Kiowa Creek, Colorado. Findings of these appraisals are applied to methodological studies, including effects of reduced floodplain risk on damages and land use, and evaluation of recreation benefits. At the present time, technical evaluation reports for Honey Creek, Plum Creek, and East Willow Creek, are in process of agency review and clearance for publication.

Overall results of project evaluations to date are not conclusive with respect to verification of preinstallation expectations. Anticipated benefits of the watershed installations were based upon mitigation of flood, erosion, and sedimentation losses resulting from storms of infrequent occurrences, as well as those of 5-year intervals or less. Although a 5 or 10 year period of observation is too short a period to fully appraise the effects of most watershed projects, some trends are indicated. The number of measures installed in general were less than the number recommended, especially with respect to structures. Flood damages in all of the watersheds studied were less than would have occurred in the absence of improvements. Considerable recreational use is being made of the reservoirs and surrounding areas of floodwater-retarding structures in several of the watersheds. Although not quantified in monetary terms, considerable benefit has resulted from recreation over and above any type benefit planned or appraised during project formulation.

2. Washita River Basin, Oklahoma and Texas

Economic studies to identify and evaluate physio-economic relationships affecting the design and implementation of watershed development and management, including evaluation of actual and potential effects of upstream watershed development on changes in use of floodplain land, and values of water supplies for irrigation and recreation, are conducted in the Washita River Basin. The basin, one of 11 designated for development of watershed projects for upstream flood control and soil erosion prevention by the Flood Control Act of 1944, contains 6,500 square miles of land area, over 90 percent within the state of Oklahoma. Research is conducted at the Watershed Economic Research Laboratory, Stillwater, Oklahoma.

In connection with the ongoing irrigation study, a series of selected crop budgets was prepared for different irrigation levels by crops for average weather conditions in Roger Mills County. Tentative estimates--undergoing critical review at the present time--were made of production requirements, costs, and expected returns for selected irrigated crop enterprises, including cotton and wheat.

A land-use study of four groups of watersheds, representing different areas of the Upper Washita River Basin, is continuing. Each group includes a watershed with installed floodwater-retarding structures and an unprotected watershed. In three of the watersheds, the protective structures have been installed more than 5 years. In general, more intensive farming is practiced on the protected bottomlands than on the unprotected ones. Observations on land use changes in this sample watershed will continue in future years.

C. Development of Methodology and Techniques for Selected Economic Evaluations

Analysis of flood damages to growing crops and pasture continued, from

field schedules taken on selected watersheds in the Southern Piedmont, Southern Appalachian Ridges and Valleys, and Blue Ridge land resource areas. Selected samples of the data were subject to multiple correlation and regression analyses. Results of the analyses indicate highly significant correlations between values of the variables investigated and the percent gross flood damage sustained by each crop. Although unexplained variations limit the flood damage predictive value, it is felt that the results of the analysis do have value in estimating the average damage that would be sustained within a total watershed by all the corn or pasture that might be flooded. It is hoped that additional examination of the various data will indicate that flood damage rates are transferable from one watershed to another, with only minor modification for such factors as season or stage of plant development. This is the major objective of the continuing study.

Special studies are being conducted in the economics of outdoor recreation. The major purpose of a Washington-centered study is to identify variables affecting recreation use and, if possible, develop a predictive function for use in planning and evaluating water development projects. A multi-regression analysis of 5 dependent variables has been completed. Analysis to date indicates a more intensive use of small water bodies than large ones. Greater intensity of use of small lakes was found in each of the 8 regions of the United States which were studied. It was also found that the amount of land available for recreation use adjacent to the lake or stream was not a significant factor in the recreation use of the area. Work is now underway to measure the effect of locations and population of cities and towns on the recreation use of public facilities.

Another study, concerned with the analysis of schedules from 119 fee-fishing lakes in Pennsylvania is still in a preliminary stage. Indications are that many fee-fishing lakes are not profitable operating units; few operators depend upon them as a primary source of income. The lakes are small in absolute size and number of patrons. In general, trout lake farms are smaller and more intensively managed than nontrout lakes. Thus, they are easier to assess from an economic viewpoint. A detailed and complete economic analysis of these lakes in conjunction with supplementary cost and returns data will be prepared in a final report.

D. Secondary Impacts of Watershed Resource Development Projects on the Local, Regional, and National Economies

The larger goals of project development are consistent with stated major objectives of increased national income, regional growth, and economic stability. In contributing to these national objectives, economic impacts of resource development are not limited to primary benefits. Thus, all benefits and costs of resource development projects need to be evaluated in a manner that permits their identification by sectors of the economy affected indirectly. Consequently, increased research emphasis is being given to analysis and understanding of secondary impacts.

During the year, a rigorous input-output analysis of the secondary impacts of watershed development was completed. The study placed emphasis on increasing understanding of the economic processes which generate local secondary income and on estimating ratios of secondary to primary income for one local area. For purposes of the study, net primary and net secondary income from watershed projects were expressed in terms of disposable income to recipients. The indirect effects of agricultural and of recreational income from the projects in Roger Mills County, Oklahoma, were compared. For each assumed \$100,000 increase in gross receipts to farmers in the County, there was an estimated net (disposable) income to farmers of \$26,867. On the average, each \$100,000 of gross receipts to farmers generated \$77,845 in gross receipts to other sectors of the local economy and a net income of \$16,457 to these sectors. Thus, the local gross-receipts multiplier of farm income was 1.78, and the local net-income multiplier was 1.62. According to these estimates, farmers would receive 62 percent of the increases in total local net income from projects built exclusively for agricultural purposes. With analytical refinements derived from continuing research, the methodology developed for this study has the potential for wider application in understanding and analyzing secondary impacts of resource project development.

New studies which will include tentative appraisals of value added in production are underway. Additionally, methodological studies of input-output models are also being expanded, with emphasis on minimizing costly data input requirements consistent with attaining specified levels of accuracy.

E. Development of Planning Criteria, Economic Standards, and Analytical Methodology for RC&D Projects

Additional research responsibilities were undertaken in support of a new, broad-gauged rural resources program of the USDA authorized by the Food and Agriculture Act of 1962, PL 87-703.

Ten projects, embracing a wide variety of socio-economic, planning, and technical problems, are currently authorized for planning. These are located in Vermont, Pennsylvania, Indiana, Wisconsin, Minnesota, Georgia, South Dakota, New Mexico, Idaho, and Oregon. Technical objectives of the proposed projects are diverse and complex, including full development and utilization of woodland resources, enhancing the supply and quality of municipal water resources, development of various income-producing enterprises, and reclamation and reforestation of strip mine areas.

Field personnel of the River Basin and Watershed Branch have assisted local sponsors and SCS Project Coordinators in their planning efforts through compilation of basic information on the economies of the project area, the provision of published studies and reports relevant to the specific economic problem, and the conduct of general feasibility of studies of proposed project measures.

Efforts at the Washington level have been directed toward outlining the concepts, principles, procedures, and criteria appropriate to the selection and planning of promising projects and project measures and their potential impacts on rural employment and income. Methodology is being developed to predict potential employment and income impacts before project installation and to evaluate impacts following installation in order to improve planning criteria and program effectiveness.

AREA NO. 11. WATERSHED PROGRAM ANALYSIS

PUBLICATIONS-USDA AND COOPERATIVE PROGRAMS

D. Secondary Impacts of Watershed Resource Development Projects on the Local, Regional, and National Economies

Jansma, J. Dean and Back, W. B. 1964. Local Secondary Effects of Watershed Projects (A case study of Roger Mills County, Oklahoma). ERS 178, in cooperation with Oklahoma Agricultural Experiment Station. 28 pp.

[illegible]

Line Project Check List--Reporting Year October 1, 1963 to September 30, 1964

Work and Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Project Incl. in	
			Summary of Progress (Yes-No)	Area and Subheading
RDE 2	<u>Water Use and Management</u>			
RDE 2-1	Economic appraisal of agricultural water use and supply	Washington, D. C.	Yes	2-A
RDE 2-2	Improved methods for the economic evaluation of land and water resource development projects and programs	Washington, D. C.	Yes	2-B
RDE 2-3	Economic appraisal of humid-area irrigation trends, potentials, and water values	Washington, D. C.	Yes	2-A
RDE 2-4	Economics of watershed management	Washington, D. C.	Yes	2-B
RDE 2-5	Economics of land forming for water management in selected Eastern States	Ames, Iowa	Yes	2-B
RDE 2-6	Economic appraisal of irrigation water conveyance systems in California	Berkeley, Calif.	Yes	2-B
RDE 2-7	A study of the characteristics, use, and occupancy of rural flood plains in the United States *	Chicago, Ill.	No	---
RDE 2-8	An economic study of values of water for irrigation and competing uses in the Upper Colorado Basin	Fort Collins, Colo.	Yes	2-A
RDE 2-9	Values of water for irrigation in the Willamette Valley	Corvallis, Ore.	Yes	2-A

* Terminated during reporting year.

Line Project Check List--Reporting Year October 1, 1963 to September 30, 1964

Work and Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Project Incl. in	
			Summary of Progress (Yes-No)	Area and Subheading
RDE 4-1/	Land Tenure			
RDE 4-1	Development and analyses of basic farm tenure information	Washington, D.C.	Yes	3B-A
RDE 4-2	Appraisal of economic aspects of land tenure laws	Iowa City, Iowa	Yes	3B-B
RDE 4-3	Maintenance of information of farm leases	Washington, D. C.	No	-
RDE 4-4	Analysis of the family corporation as it affects tenure and resource use	Ames, Iowa	Yes	3B-B
RDE 4-5	Economic appraisal of interrelation between farm tenure arrangements and agricultural production control programs in the Southeast	Raleigh, N. C. Blacksburg, Va.	Yes	3B-C
RDE 4-6	Analysis of legal economic aspects of con- tract farming	Iowa City, Iowa *	Yes	3B-B
RDE 4-7	Analysis of land tenure problems and policies of Puerto Rico	Ames, Iowa Washington, D.C.**	Yes	3B-C
RDE 4-8	Resource returns and tenure adjustments	Urbana, Ill. ***	Yes	3B-C

1/ The work project RDE 4 corresponds to Area 3B in this report.

* Contract completed and project terminated during reporting year. Preparation of manuscript being done under RDE 4-2.

** Field location closed and researcher station in Puerto Rico was transferred to Washington and subsequently to Ames, Iowa.

*** Initiated during reporting year.

Line Project Check List--Reporting Year October 1, 1963 to September 30, 1964

Work and Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Project Incl. in	
			Summary of Progress (Yes-No)	Area and Subheading
RDE 6	<u>Economic Development Problems and Programs in Rural Areas</u>			
RDE 6-1	The dynamics of physical and human resource use adjustment in specified areas	Lexington, Ky. Ithaca, N. Y. Blacksburg, Va. Morgantown, W. Va. Washington, D. C.	Yes	6-A
RDE 6-2	An evaluation of rural resource use and potentials for economic development--selected low income areas in Arkansas and adjoining States	Payetteville, Ark.	Yes	6-B
RDE 6-4	Training and education as a means of providing more job opportunities for workers in low income areas	Lafayette, Ind.	Yes	6-A
RDE 6-5	An analysis of factors affecting resource adjustments in low income rural areas of Michigan	East Lansing, Mich.	Yes	6-A
RDE 6-6	Economic appraisal of opportunities for outdoor recreation enterprises on farms in southeastern Ohio	Columbus, Ohio	Yes	6-B
RDE 6-7	Resource adjustments to provide income from outdoor recreation enterprises *	Lafayette, Ind.	Yes	6-A

* Initiated during reporting year.

Line Project Check List--Reporting Year October 1, 1963 to September 30, 1964

Work and Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Project Incl. in Summary of Progress (Yes-No)	Area and Subheading
RDE 7	Incomes, Employment, and Resources of Rural People			
RDE 7-1	An economic appraisal of adjustments in the use of resources on low income farms in the Willamette Valley of Oregon	Corvallis, Ore.	Yes	7
RDE 7-2	An appraisal of farming adjustments associated with increased nonfarm employment of farmers in a commercial farming area of Texas *	College Sta., Tex.	No	7
RDE 7-3	Opportunities for adjustments of farms and farm families in low-income farming areas in Mississippi	State College, Miss.	No	7
RDE 7-4	Facilitating farm enlargement and extensive land uses in low-income areas of North Florida	Gainesville, Fla.	No	7
RDE 7-5	Appraisal of successful farms and farmers in a low-income area *	Washington, D. C.	No	7
RDE 7-6	Income and resource characteristics of farm-operator families	Washington, D. C. Raleigh, N. C.	Yes	7
RDE 7-7	Analysis of the concept and development of measurement techniques for economic underemployment **	Washington, D. C. Baton Rouge, La.	Yes	7
RDE 0-0-1	Economic analysis and appraisals for pro- grams of area redevelopment, rural development, or general economic development in rural areas of low pro- duction and income **	Washington, D. C.	No	7

* Terminated during reporting year.
** Initiated during reporting year.

Line Project Check List--Reporting Year October 1, 1963 to September 30, 1964

Work and Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Project Incl. in	
			Summary of Progress (Yes-No)	Area and Subheading
RDE 8	Rural Area Economic Structure and Economic Growth			
RDE 8-1	The relationship of urban and industrial development to low incomes in agriculture	Washington, D. C.	No	-
RDE 8-2	Evaluation of alternative development oppor- tunities in low-income rural areas	Clemson, S. C.	Yes	8-B
RDE 8-3	Effects of national economic development upon the development of low income farm areas in North Carolina **	-	No	-
RDE 8-4	Analysis of economic development, structure, and areas of potential growth in the Appalachian Region	Washington, D. C. Morgantown, W. Va. University Park, Pa.	Yes	8-A, 8-B
RDE 8-5	Analysis and delineation of functional economic areas *	Washington, D. C.	Yes	8-A

* Initiated during reporting year.

** Terminated during reporting year.